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# modern plastics

NOVEMBER 1940
VOLUME 18 NUMBER 3

## DECEMBER

An authoritative treatise on the molding of all types and classes of thermoplastic optical lenses will be featured next month. Perhaps no problem that has confronted the molders has been attended by more intricate and involved engineering problems than this. C. H. Whitlock's article will include a discussion on the construction of dies for both compression and injection molded lenses.

For this issue we have also scheduled an exhaustive study on the advances of plastic applications in the fluorescent lighting field. This article promises to be a frank interpretation of the position of plastics in this rapidly growing branch of modern illumination.

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IT IS NOT ENOUGH that workers in molded and laminated plastics in Richardson plants possess keen eyes, deft fingers, and an unusually high degree of skill.

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MODERN PLASTICS
WILLIAM T. CRUSE, Editor

NOVEMBER 1940 VOLUME 18 NUMBER 3

# Plastics on wheels

**Decorative applications of plastics for automobile interiors are being augmented by noteworthy exterior uses. Plastic specifications included here are significant**

AMERICA'S pace-setting automobile industry is continuing to find additional jobs for plastics. They are being employed more extensively than ever before as evidenced by the diversity of original applications engineered into the 1941 cars which are now making their debut.

Anyone visiting the research or testing laboratory of any leading automotive manufacturers would soon learn that the study of plastics is one of their most active projects. That they have been for some time is clearly shown through their ever-increasing application. In the "41" models they are being used more extensively than ever before, both for functional parts and for utilitarian decorative purposes.

The automobile industry is famous for its frequent change of pace. Raw materials have been required through the years to keep up with these ever-increasing new demands. Plastics which were adopted by the industry in its youth have kept abreast of this requirement. Some of them as they were initially applied have been cast aside to be reincarnated in another form. Still others have arrived fresh to perform new tasks, to meet new conditions.

The 1941 models account for many distinctly new developments in the use of plastics. They include increasing numbers of applications of laminates; for the first time the extensive exterior use of molded parts is appearing; the widespread application of continuous length extruded thermoplastic material is accomplished; the use of metal inlaid in a thermoplastic

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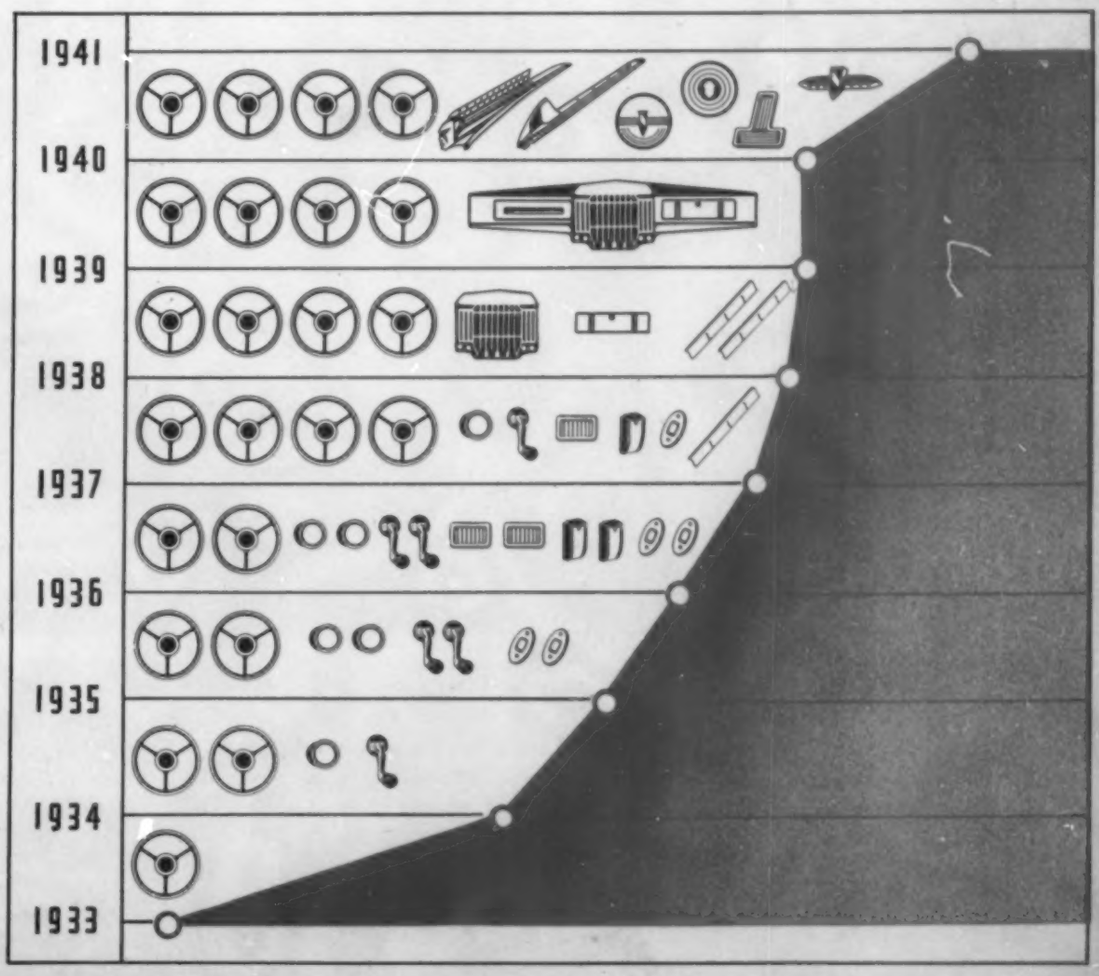



***1—Chart depicts the startling growth of plastics for style and decorative applications in the automobile industry from 1933 to 1940. The influence of plastics in interior decor is now being extended to exterior adornment as evidenced by the many plastic innovations on the 1941 models***

2

3

**2**—*Injection molding and finishing divisions of the Ford Motor Co. plant represent one of the largest injection molding operations in the United States. The plant layout is so arranged that the two departments are side by side in order to centralize and coordinate plastics production.*
**3**—*The compression molding press battery of this plant is an impressive example of speed and economy harnessed for mass production of plastic accessories as well as utilitarian parts*

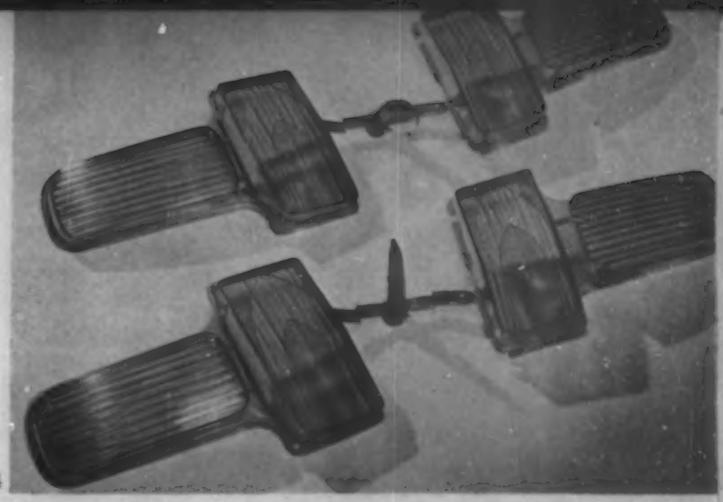
material for nameplates and other parts is significant; lacquering the unexposed or reverse side of transparent plastics in vari-colored decorative effects to serve as horn buttons has been extensively employed; and the initial use of lignin in combination with other materials for gaskets is witnessed for the first time.

Probably the most significant and the most far-reaching development of the last eighteen months in the automobile industry has been the exhaustive study of all types, kinds and classes of plastics. This research activity along with the arrival of innumerable new applications has given rise to, for the first time more or less, formal but not final specifications. Specifications earmark the season. Heretofore it has been sufficient to accept limited performance as a guide. Because of the important role plastics are now taking, coupled with the fact that they are becoming a major raw material upon which reliable performance is more and more dependent, this step has become necessary. It is nearly universal practice among the manufacturers. When it is realized that there are 85 plastic parts in a single motor car (not counting the plastics used in making safety glass), their importance can be appreciated. These parts are distributed in all parts of the car from bumper to bumper.

### Laminates*

The use of laminated phenolics in the automobile industry has been increasing every year. The answer to the question "why?" is an examination of their electrical, mechanical and chemical properties. With tensile strengths up to 15,000, traverse strength of 25,000 lbs., compressive strength of 49,000 lbs., dielectric strength of 750 volts per mile and moisture absorption down to 3.3%, obviously they are desirable materials. These materials are almost as essential to an automobile as the wheels. Certainly they are vital to the operation of the engine and other parts of the operating mechanism. Good illustrations of laminated

* This data submitted by Synthane Corp.



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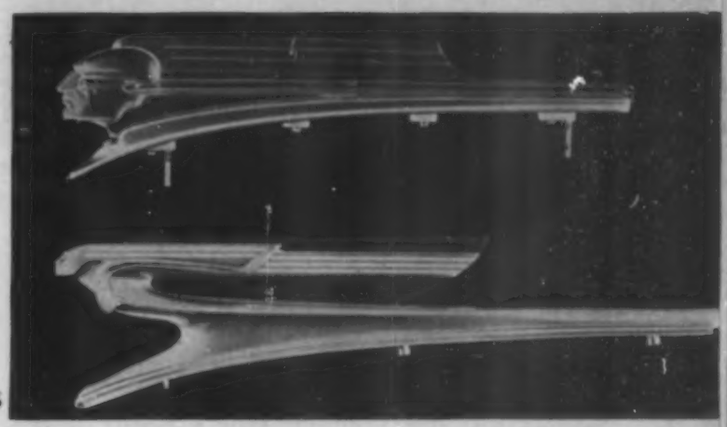

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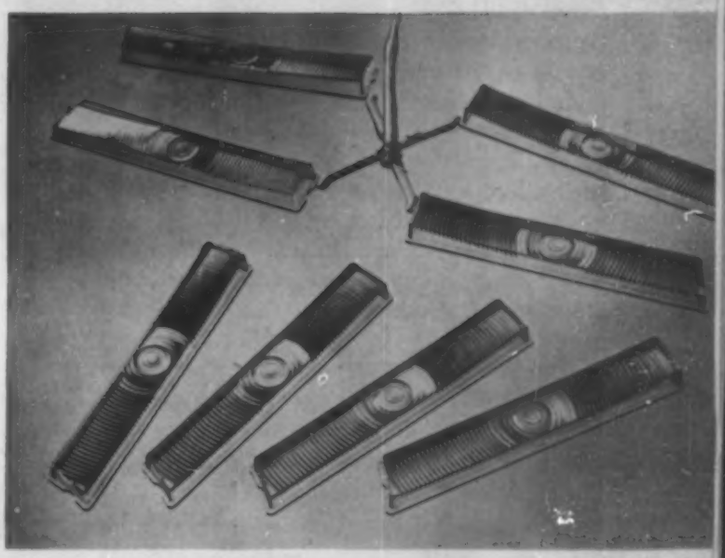

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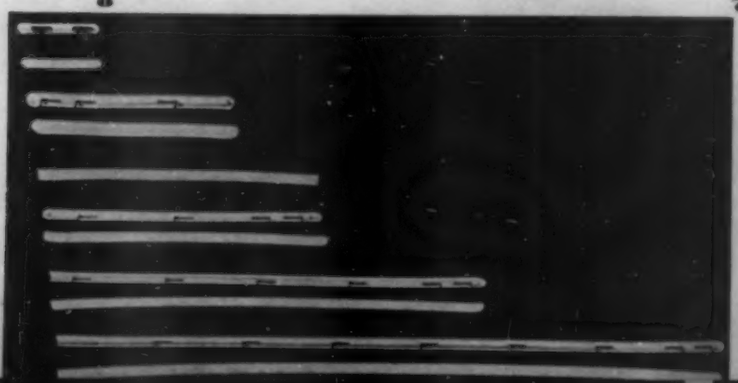

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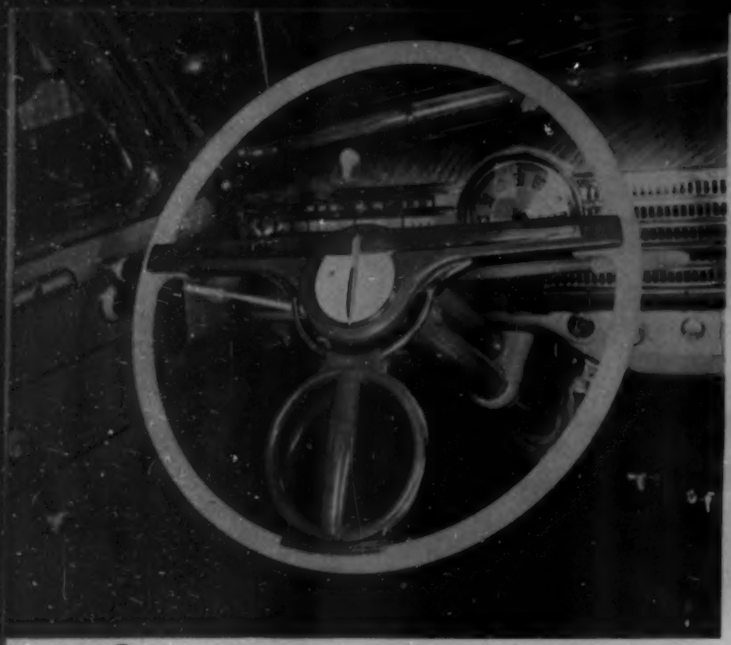
***4—Tenite II Buick tail light lenses injection molded by General Industries Co. 5—Modern radiator ornaments are injection molded of Crystalite by Consolidated Molded Products Corp. 6—Pontiac fender lights are injection molded four at a time of acetobutyrate. 7—Interior of Ford Super DeLuxe model has knobs and escutcheon plates injection molded of acetobutyrate. Continuous length extruded cellulosic strips by Detroit Macoid Co. (8) are used for interior body trim***



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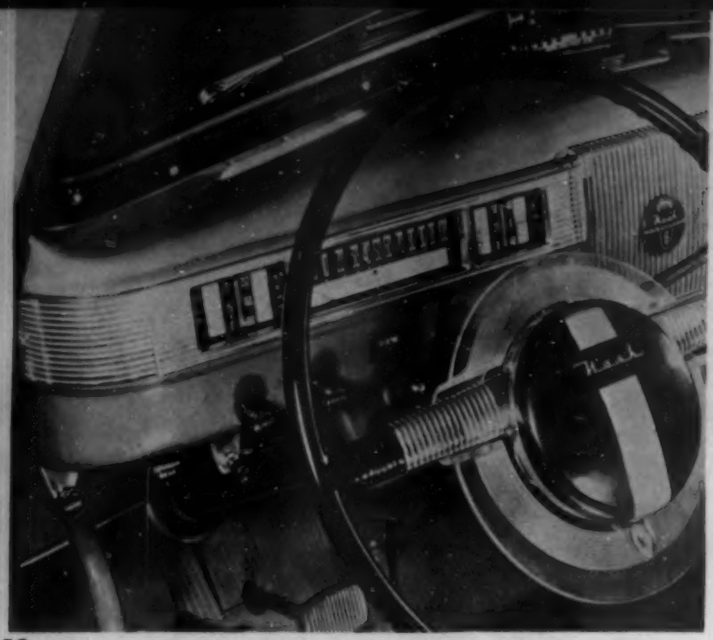

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applications are found in timing gears, cam shaft washers and washers used in the steering column gear shift assembly. In the latter application the washers must work with or without grease.

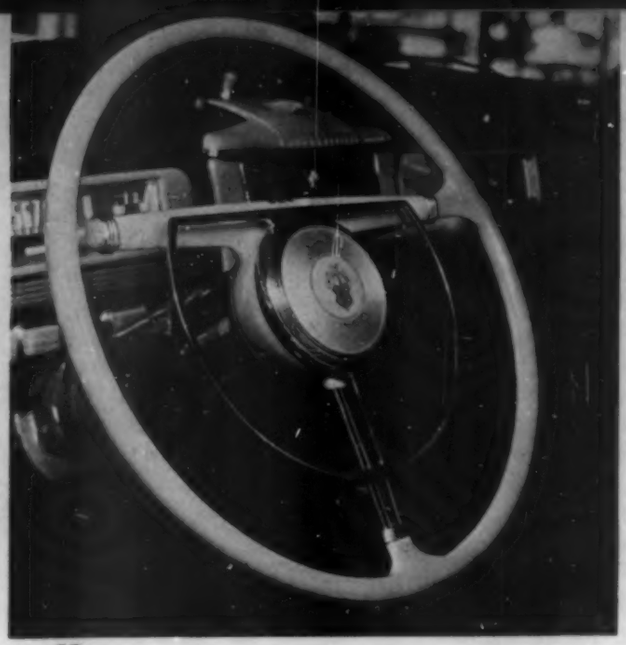
The water pump seal retainer washer is a good example of chemical and corrosion resistance combined with good wearing qualities when water or liquids miscible with water are used as a lubricant. To insure against leakage and at the same time eliminate the necessity of "running in," both faces are ground or lapped flat and parallel to within .0005 in. When assembled the washer bears against a steel face and must withstand speeds of better than 4000 rpm and 40 lbs. thrust load. Since it is impossible to lubricate with oil or grease, the liquid in the cooling system must act as the lubricant. This liquid in summer ranges from pure to corrosive alkaline water and in winter may be any type of antifreeze solution. Another item that comes under this general classification is a control valve in the heating system. Freedom from tendency to warp and chemical and corrosion resistance are of greatest importance.

Differential thrust washers have proved their superiority in many ways under the most severe conditions. A laminated phenolic washer having a spherical radius is placed in back of each of the pinion gears and a flat washer in back of each of the side gears. It is generally conceded that practically all of the grease is squeezed from in back of the gears when the pressure reaches approximately 40 lbs. per square inch. When one of the rear wheels of an automobile is travelling faster than the other, particularly with bad road conditions, it is not unusual to develop pressures of better than 1000 lbs. per sq. inch. Certain corrosive properties are built into extreme pressure lubricants to prevent surface welding. These washers must withstand high pressures without lubrication for short periods of time and at the same time be resistant to the corrosive properties of the lubricant.

Combined electrical and mechanical properties are required for certain distributor parts. There are two general types of breaker arms in use. One type is a metal arm with a laminated bushing in one end, contact point at the other end, and follower block also of laminated phenolic located at approximately the center of the arm. The bushing fits over a post, attached to base of distributor, and insulates the arm from it. The follower block is held against the cam by spring pressure making and breaking the contact several thousand times per minute when engine is speeded up. The bushing must not absorb moisture as any swelling would cause it to bind on the post, while the follower

11

***9—Compression molded Chevrolet wheel of Plastacele has an auxiliary steering aid to facilitate comfort in motoring. 10—Nash wheel is compression molded of deep maroon Monsanto cellulose acetate with a fingertip-touch horn ring molded of clear Crystalite. Modern styling emphasizes two-tone color combinations for car interiors. 11—Injection molded acetobutyrate De Soto horn button has the company name inlaid in metal by Plastic Inlays, Incorporated***



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**12**—*Simply designed Packard wheel of molded Lumarith features a horn decorated by the "See Deep" process. Treatment of the rear surface of the transparent molded piece gives a three-dimensional depth effect while presenting a smooth exterior contour.* **13**—*Metal inlays in injection molded acetobutyrate name plates are practical and add a note of distinction. Such inlaid work is a prominent feature on current models.* **14**—*Compression molded metal inlaid knobs by American Insulator Corp. are mounted on injection molded acetobutyrate escutcheon plates*

block must have exceptional wearing qualities. The other type arm is made entirely of phenolic with the follower block formed on one end and the contact point attached to the other end. The center of the arm is drilled for insertion of oilless bushing which fits over post attached to base of the distributor. The phenolic type arm must have the same good mechanical and electrical properties as the bushing and follower block of the metal arm and in addition very high impact strength and resistance to fatigue. In both types of arms, the points become oxidized and pitted before the follower block becomes sufficiently worn to require adjustment.

The present distributors have advantageously employed the improvements which have been achieved in the laminates. Accompanied by innovations in design, remarkable performance is now attained.

### Exterior applications

The industry has wisely and cautiously undertaken employing plastics for exterior applications. Outside exposure has been one of the difficult hurdles for plastics to clear. They have been in training for the undertaking for some time. The transparent cellulosics, by virtue of their clarity, were from the beginning interesting materials. They were used very early in sheet form for side curtains in the popular touring phaetons of yesterday. In molded form they are only now coming into their own. The acetate-butyrate ester is proving very satisfactory. Preceding its adoption it made many trips to Florida and to other exposure fields for investigation. It went through the paces in the laboratories in correlated accelerated aging tests. The methylmethacrylates have joined in this program. They, too, are now to be found on parts exposed to the weather. The current Pontiac fender light lenses and the Buick directional signal lenses exemplify applications of acetate butyrate. The Pontiac and the Oldsmobile radiator ornament demonstrate the suitability of the methylmethacrylates for the purpose. Hardware and decorative parts remain for another season.

### Continuous length extruded applications

Compression and injection molded plastics along with the laminates have long been extensively used in devious ways for various automotive parts. Continuous lengths of extruded thermoplastic or thermosetting materials have been slow in developing. While the art of processing materials in this manner has for a long time been commercial, it is only in recent months that outlets have developed in industrial fields. In Germany they have extruded both thermoplastic and thermo-

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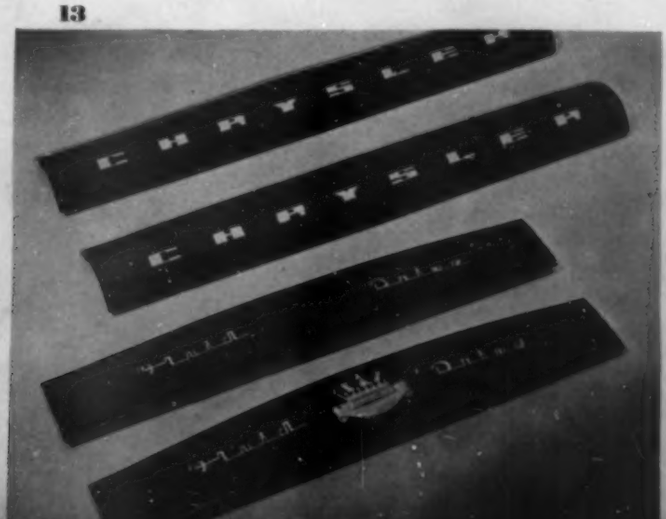

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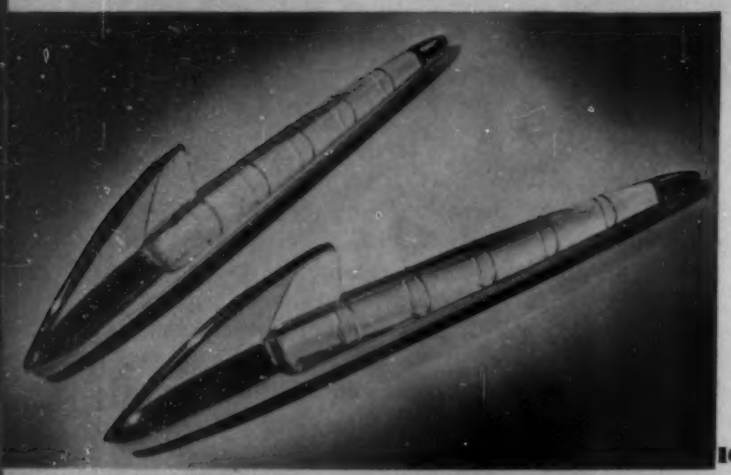

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**15**—*Oldsmobile horn ring units are made structurally sound and attractive through the use of injection molded Plastacele by Michigan Molded Plastics, Inc.* **16**—*The same car manufacturer employs radiator ornaments injection molded of Lucite, a good example of the trend toward exterior applications of plastics.* **17**—*Group of Cardinal "See Deep" horn assembly Lucite name medallions shows the variety of pattern and design possible*

setting plastics for years. In America we have only commercially developed processing the thermoplastics, largely nitrocellulose types, up until recent years. The recent work which has been accomplished whereby continuous length profile rod may be produced from dry powder has evolved new possibilities, not least among them being the automotive field. Previously the lengths were shorter and narrower in cross section, now they are longer and much wider. They have become a substantial decorative unit on a car's interior. The Chrysler "New Yorker" is a classic demonstration. In this car the instrument panel is substantially constructed from injection molded parts. Its sleek, well-designed lines are carried by flat profile rod trim across the width of the front doors in a band about $1^3/_4$ in. wide across the width of the rear doors in like manner into the rear quarter. A smooth flowing continuity of decorative feeling is achieved and the effect is striking. Colors of material may readily be varied to harmonize with their decorative trim. Ford, Packard and Hudson have also adopted this type of plastic strip for decorating the interiors of their cars, while not as extensively, still very effectively.

### Inlaid metal

The effect of plastics inlaid with metal for certain purposes is striking. This technique has been largely restricted heretofore to personal articles.

While it has made some advances in other fields, it has taken a group of automobile manufacturers to really understand and appreciate the style potentialities. The process for satisfactorily producing inlaid plastics for all practical purposes has been perfected. Chrysler on its line is using this system for making their instrument panel nameplates. Their cars which have fluid drive have adopted a plastic plate with the words "fluid drive" inlaid with metal. De Soto has a horn button fashioned in this manner. General Motors, Ternstedt Division, is making some of their hardware with inlaid knobs.

### Decorative lacquered transparents

The jewel-like plastic gems which are mounted in the center of the steering wheels on the Buick, Cadillac and Packard are made by the "See Deep" process. Essentially this consists of lacquering the parts on the under side with the selected colors to obtain the intended result. The recessed designs are accomplished in the molding operation. The dies are constructed with the required inscription or insignia. This development has been largely contingent upon two things: plastics of excellent transparency and compatible lacquers. Methylmethacrylate is proving to be thoroughly satisfactory and applications of this character seem assured of a promising future.

### Lignin

Probably one of the most notable commercial developments of all has been the initial application of molded

lignin in the form of gaskets. The perfection of a process whereby materials of this class may be processed is a noteworthy advance. The lignin is mechanically mixed with neoprene or other synthetic rubbers of the butadiene type, and then molded. It is made into gaskets of numerous shapes and sizes which are used in various places on several makes of cars. Gaskets of this type resist oil, gas and grease. They also have high heat resistance and are nonflammable. Their compression ratio is from 25 to 50 percent and they possess a minimum of cold flow. In cutting gaskets from sheets of lignin material there is practically no waste for the scrap material may be re-used.

An unlimited amount of research has been involved in this successful undertaking. Soon sheets of the material 3 ft. by 4 ft. by from $^1/_{32}$ in. to 1 in. will be available in quantities.

### Injection molded thermosettings

Thus far there has been no motor car manufacturer who has either been supplied or who has commercially produced by injection molding parts from thermosetting materials. Important progress has been made here. One manufacturer who does considerable molding, who is also a leader in research, has on more than a laboratory scale successfully injection molded thermosetting materials. Standard thermoplastic equipment and practice have served as the basis for the program. In another year we may see this method accounting for substantial production.

### Today and tomorrow

Standing on the "okay line" where the final factory test and inspection are given the cars as they are being released for delivery one is impressed by their well-groomed, modern-as-tomorrow, stylish appearance. In their very realistic mechanical world of their origin, they appear as objects of art. Behind the wheel of a "fresh as paint" new job you are impressed with the consideration which has been accorded style in addition to the engineering genius. Modern cars are harmonious symphonies in color. Within and without the shades and tones of colors and cloth are blended to satisfy the demanding, fastidious public. Plastics are fitting into this scheme very comfortably. They are discharging the mechanical and chemical duties assigned to them creditably. They are in step with any and all style requirements. *(Please turn to page 84)*

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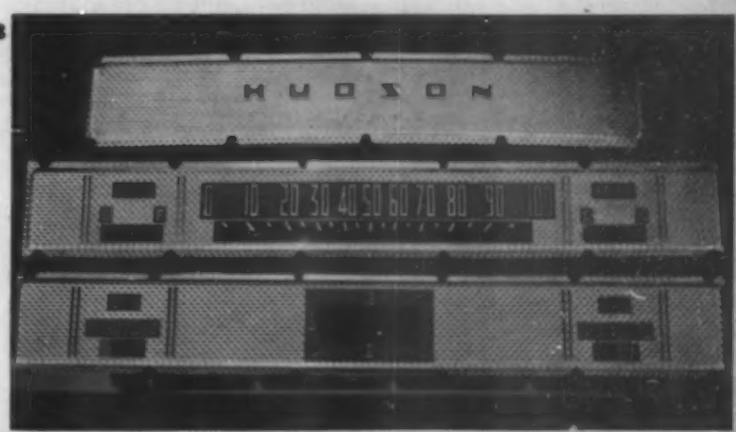


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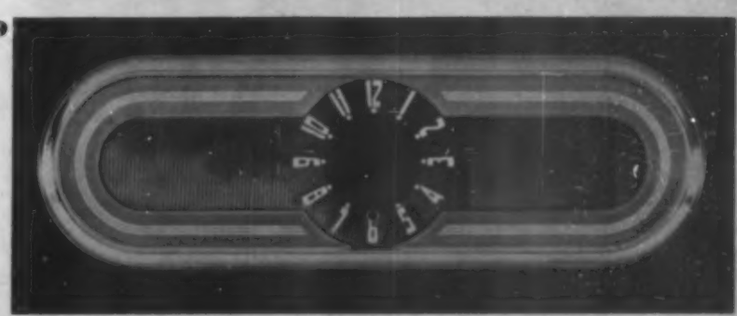

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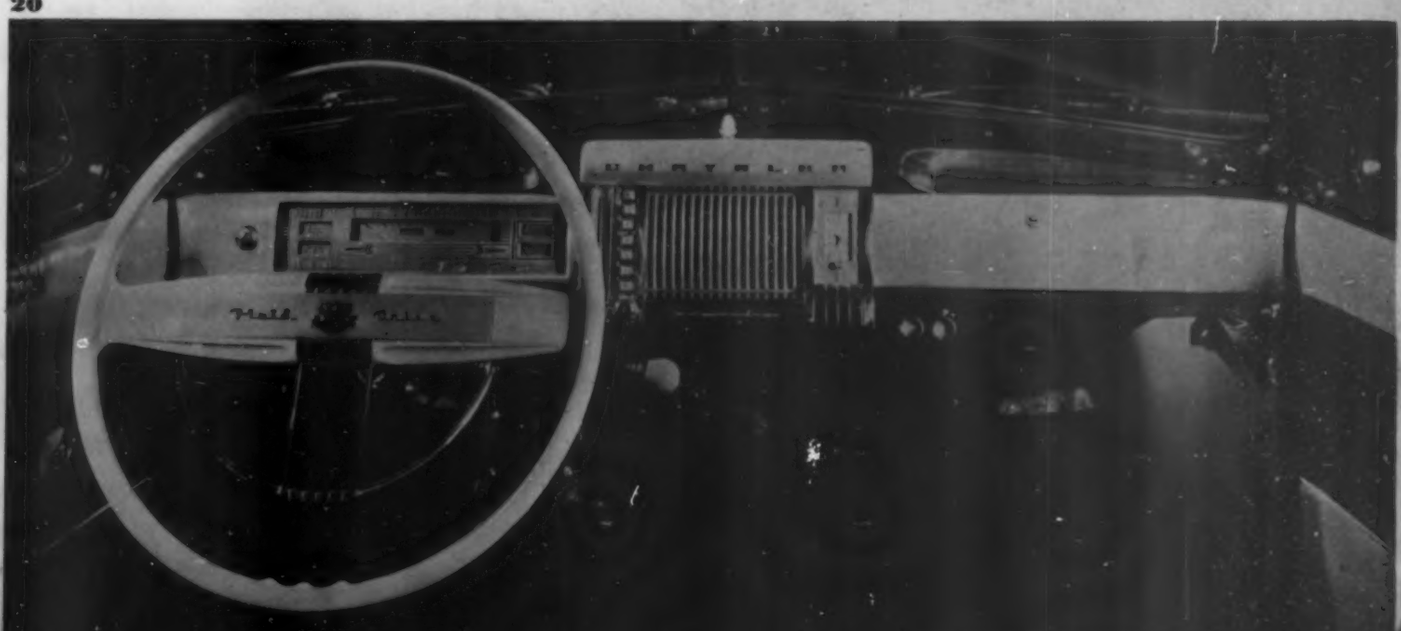


**18**—*Hudson name plates and instrument panels employ Amerglo for its good appearance and practical value.* **19**—*Oldsmobile's modern clock dial of clear methyl methacrylate has an elongated shape that is decidedly new.* **20**—*Award-winning Chrysler instrument panel is made up of injection molded Tenite II parts with metal inlays. Extending to the doors a flowing line is carried out by the use of matching extruded panels*

# Seats of tomorrow—today!

by W. C. GOGGIN*

**Extruded vinylidene chloride plastic is being woven into durable seat covering material for subway cars**

DAILY more than 2,000,000 New Yorkers from all walks of life travel over the city's excellent subway systems. They expect and get the world's finest ride for five cents.

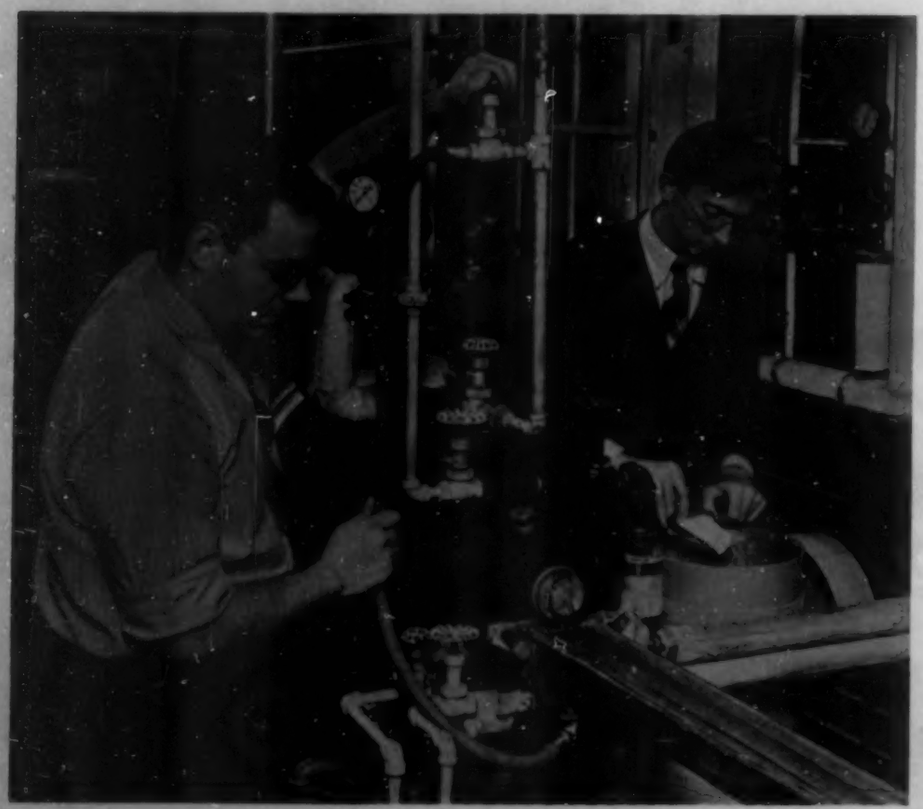
To provide this convenient form of transportation, however, and to give patrons the maximum in safety, speed and comfort, is no insignificant problem for the New York Subway Commission. The heavy volume of traffic which daily throngs its cars makes extraordinary demands upon all types of equipment, and officials ever must be on the alert for new materials which will better meet the extreme service conditions to which this equipment is subjected.

One of the greatest problems which has long confronted the commission has been that of the seats, or more especially the seat coverings. Natural reed or rattan, used extensively for this purpose because of its durability and long-wearing qualities, is subject, however, to certain disadvantages. Being porous and hence absorptive, it soon becomes objectionably soiled, thus giving a drab, dingy appearance to the car. Moreover, once soiled, it may not be cleaned satisfactorily. In addition, the stiffness of woven natural reed makes it uncomfortable for seat covering.

It is not surprising, therefore, that a search was instituted for a better seat covering material. After an extensive investigation of all natural products, metals, and synthetic fibers, vinylidene chloride plastic was selected. This plastic is strong, tough, flexible material, one of the most recent to appear on the market, having achieved a position of commercial importance only during the past year. The plastic has for its raw materials, the inexpensive and almost limitless domestic supplies of crude oil and brine.

The history of the development of this new resin is not extensive. However, it has been for several years the subject of laboratory research. Such has added much to the industry's knowledge of the material,

* Special Products Division, The Dow Chemical Company.



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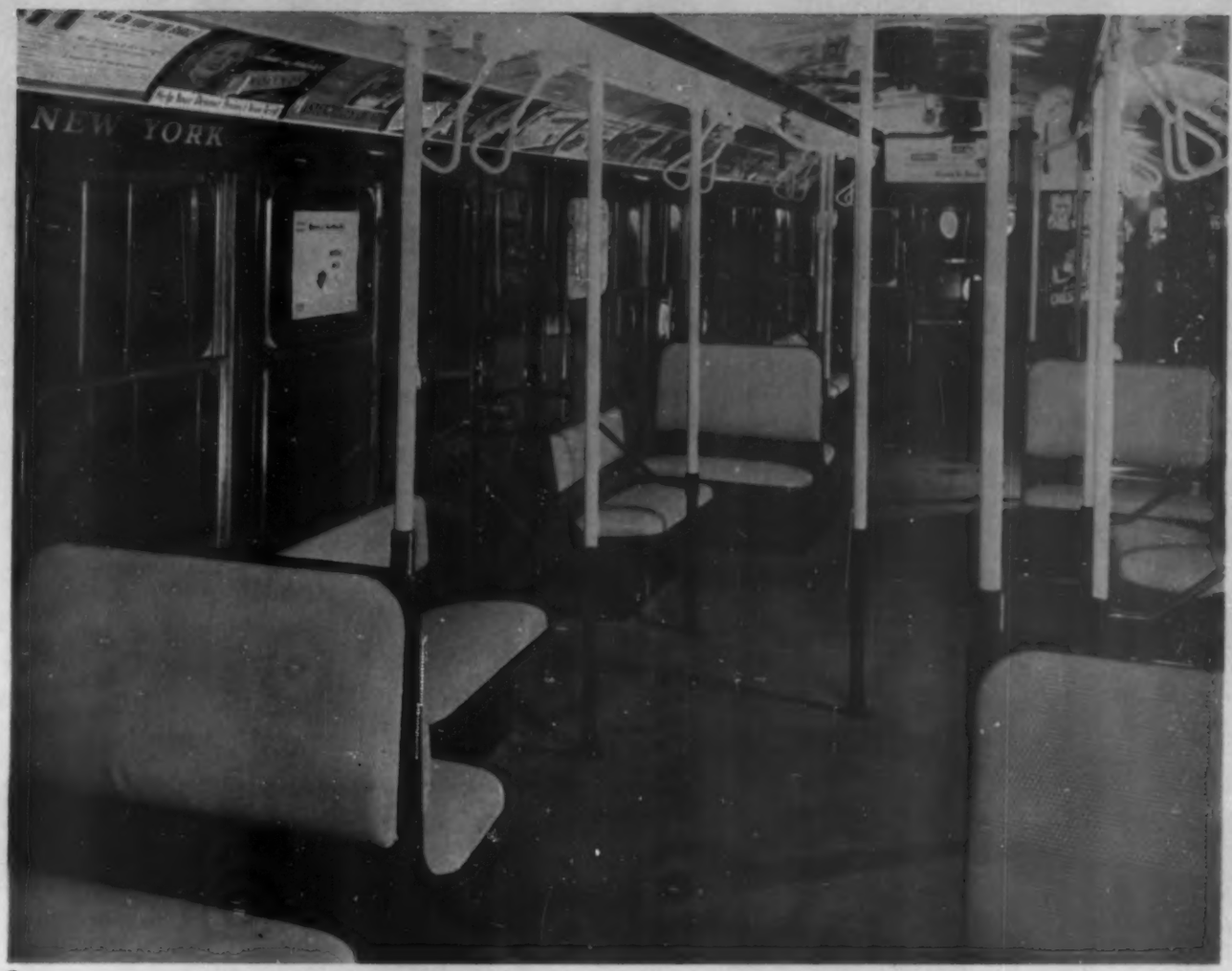
***1—Saran (vinylidene chloride resin produced by Dow Chemical Co.) is fabricated into continuous strips by the use of special extrusion technique at the Irvington Varnish & Insulator Company***

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**2**—*Tough, flexible, rattan-like Saran strips, woven into seat coverings brighten car interiors of New York City's Independent Subway System*

and first led the subway commission to investigate its application as a seat covering.

The material is well adapted for this purpose. It is a thermoplastic, crystalline material having a comparatively high softening point. It differs from other familiar thermoplastics in that the latter, being of an amorphous nature, exhibits only a slight degree of fibrous crystallinity. Vinylidene chloride on the other hand, possesses this characteristic to a far greater extent. Normally these crystals lie in a random, heterogeneous arrangement, and when this is the case the plastic is found to have physical properties in the ordinary range of other thermoplastics. By mechanical treatments during fabrication, however, these fibrous crystals may be re-aligned into an orderly linear pattern. Then, when the plastic strand is stressed, each crystal theoretically assumes its share of the load and much higher values for the physical properties result. In this manner, it is possible to obtain comparatively large size filaments having a tensile strength of 60,000 lbs. per sq. in. as well as great flexing and fatigue life—necessary qualifications for seat coverings.

Another important property for a seat covering application is the plastic's water and chemical resistance. In either filament or molded form, it is essentially unaffected by inorganic salts, acids and alkalies, and is solvated by only a few of the more potent oxygen-bearing organic solvents; the material is also non-flammable, and will not burn.

Properties such as these make the plastic adaptable for use wherever extreme service conditions are likely to be encountered. Long before it was applied as seat coverings in the field of transportation, vinylidene chloride plastic was extensively employed in corrosive and mechanical duties where, it is claimed, no other material has ever been found to be satisfactory. Later as tapes, gaskets, chemical jets, nozzles and pump pistons, it is said to have given excellent service under the most exacting requirements.

The problem of the New York Subway Commission, however, is a much broader one than that of merely selecting a plastic to meet unusual service requirements.

The fabrication of subway seats from basic raw materials involves many widely divergent operations and an exact attention to details in each of them. Since, at present, no one company has expanded its interests sufficiently to enable it to handle all of these manufacturing steps, the problem was divided into its four basic operations, and each was placed with a company specializing in that type of work. The success of the development is directly due to the coordinated efforts of these four American manufacturers.

The first basic step in this process is the adequate selection of raw material for the seat covering, itself. Among methods developed for fabricating the new resin, a special extrusion and orientation process capable of making continuous rattan-like strips of unusual strength, was perfected. The problem of actually producing this type of plastic in commercial quantities was placed in the hands of one of the cooperating companies in order that they might study in relation to manufacturing processes, the operation of the unique equipment required. They made preparations to fabricate a product of uniformly high quality by close control of temperatures, pressures, and extrusion rates.

Once the continuous rattan-like strands are produced, the problem of weaving to form the covering becomes of major importance. This step was accomplished by a company specializing in weaving cane. By quickly adapting its method of manufacture to the weaving of this plastic, the organization contributed materially to the success of the entire undertaking. According to reports from the weaver there are several outstanding advantages for vinylidene chloride plastic over natural reed in this process. Chief of these is the independence of foreign sources of supply, which enables the manufacturer always to be certain of the availability of materials, an important point in view of present unsettled, world conditions. Then, too, the plastic can be handled more economically. Uniformity of the strands does away with costly sorting and sizing operations; soaking previous to weaving is also eliminated, since the material is sufficiently soft and flexible to be woven directly. Finally, the fact

**3**—*The smooth, long-wearing, plastic seats will not snag hose or tear clothing. Color is permanent and seats may be easily cleaned without removal from the car*

3

that the plastic is supplied in continuous length speeds up weaving operations, and the completed mats have an unbroken finish, which improves their appearance.

The fourth step was the application of the woven plastic mat to the seat. A pioneer company in the development of cellular latex, designed a special rubber inner cushion and assisted in the manufacture of the finished seat. This cushion, having an unusually long life, made it possible to take advantage of the wearing qualities of the covering. In addition, the soft resiliency of cellular latex and the flexibility of the plastic outstanding advantages for vinylidene chloride plastic combine to give passengers maximum seating comfort.

The finished seats were first installed in the New York subways for testing under actual operating conditions. It is reported that systematic check-ups over an extended period of time demonstrate the material's ability to withstand hard wear and abuse.

Passengers like the noticeable improvement that the plastic makes in the car's cleanliness and cheerful appearance. Attractive colors and decorative finishes do much to improve the general tone of car interiors. The increased comfort is a big advantage plus the fact that, unlike rattan, the plastic strands do not split or crack. This removes the menace of jagged splinters to clothing, especially women's hose.

From the operating standpoint, the more advanced stages of the tests show a simplification of maintenance problems and a reduction in upkeep costs. Formerly, it was necessary to return cars to the sheds for cleaning and reconditioning the seats about three times a year. Here, seats were removed, washed in a machine designed especially for this purpose, and broken or split rattan strands replaced with new fibers. Finally, seats were revarnished and placed back in the car. Now, because of the durability of the plastic, the replacement of strands is eliminated, and the smooth surface of the material makes cleaning a simple operation which can be accomplished without removing the seats from the car. Tar, gum, and other sticky substances may be removed easily through the use of ordinary cleaning solvents without any injury to the covering. Nonflammable, the plastic eliminates the fire hazard of natural reed. It is now possible for subways, street cars, buses, and trucks to have strong, flexible seats in bright, cheerful colors, seats which wear well, soil only on the surface, and may be easily cleaned.

Thus American industry, through an American plastic, solves another typically American problem and moves the nation one step nearer to self-sufficiency.

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***4—By the Heywood-Wakefield method of machine weaving processing operations are simplified and speeded up for greater economy. 5—The woven flexible plastic fiber covering is tacked over comfortable seats upholstered with Airtex cushion slabs, by Firestone Rubber & Latex Products Co. 6—One style of seat shown before installation***

# Presentation Dinner

BENEATH the twinkling lights of the Starlight Roof of the Waldorf-Astoria some 500 people gathered on the evening of October 15th to attend the finale of the Fifth Annual Modern Plastics Competition—the Presentation Dinner. To all of us interested in any way in the plastics industry, this dinner seems to be one of the most outstanding events of the year. All party lines are thrown aside, and for one long evening this plastics business is feted and toasted through the unbridled enthusiasm of its participants.

Gracing the speakers' table were, Alfred Auerbach, editor of *Retailing;* William A. Kimbel, president of the American Institute of Decorators; M. W. Petrie, Research Division Staff of the Chrysler Corp.; Morris Sanders, architect and design engineer; Watson Davis, director of Science Service; Donald Dew of Diemolding Corp.; Henry Kasch of Kurz-Kasch, Inc.; Glenn L. Martin of the Glenn L. Martin Corp.; C. F. Kettering, General Motors Research Corp.; M. R. Merryfield of Philco Radio and Television Co.; Charles A. Breskin, Alan S. Cole, W. T. Cruse and Dr. Gordon M. Kline of MODERN PLASTICS.

Plaques and certificates of merit were distributed to 42 award winners and 28 companies and individuals who won honorable mention in the Competition, after a program of entertainment and the preview of the new MODERN PLASTICS sound and color film "The Magic of Modern Plastics."

The principal speaker of the evening was Charles Franklin Kettering, inventor, manufacturer, vice-president and director of General Motors Corp. and internationally known for his work as head of General Motors Research Laboratories. For the benefit of all those who have requested copies of Mr. Kettering's address, we are printing his speech here in its entirety.

"Mr. Chairman, ladies and gentlemen: It is a great pleasure to be here. I have attended many banquets in this room, none of which I have enjoyed any more than tonight. First of all, because this is a new industry, and God knows we need a lot of them. The next reason is because I had the pleasure of sitting next to a dear old friend of mine, Glenn L. Martin, one of the greatest aviation men in America today.

"You know, I knew that this was a new industry by the kind of a dinner you served. You may not be psychologically aware of the fact that when customers and suppliers dine together, champagne and squab are not the things served, and if I were the purchasing agent here tonight, I would ask for a reduction in price tomorrow. Tough steak is the thing to serve to an old seasoned industry, and then you can raise the price.

"I have been in this plastics industry a long while.

I had one of the first molding plants west of the Allegheny Mountains. You remember that the United States used to end at the Allegheny Mountains, but we finally got some plastics. I think it was called Bakelite in those days. I do not want you to think I am too old, because I am old according to the calendar, but not so old as the little story I heard just recently about three Englishmen. One of them was dead, and the other two were out at his funeral, and they were at the cemetery. One said, 'How old was Paul?' (referring to the dead man). The other said 'He was 79.' The first man said, 'How old are you, Henry?' Henry said, 'I am 82.' His friend said '82? It hardly pays you to go home, does it?'

"I am going to talk to you for a minute about my profession, not the automobile industry. You understand there is an automobile show here, and a friend of mine said, 'How would you go about buying an automobile?' I said, 'How in hell do you go about not buying an automobile.'

"I want to talk to you about my profession—research. Research is a terribly misused word. A researcher is the glorified name for amateur, because the researcher is doing something he never did before, and that is all an amateur is. The only thing that 'researcher' carries with it that the word 'amateur' does not, is that the researcher is a professional amateur. He is an amateur in this respect, that he knows he is doing it for the first time, and it is going to be a damn rotten job when he gets it done. He is professional because he knows he is going to get hell from the management, so a researcher is just a fellow who is willing to go ahead and take all the punishment that comes with tryng to do a new thing.

"The great enemy of every profession is *something*. The only reason you do not go (*Please turn to page 94*)

# Taking it head on!

by JOHN RIDDELL, JR.

**Economically molded plastics try out a new idea for football headgear**

A PET theory, a series of experiments and a search of a satisfactory material that could be economically fabricated—that is the background for the plastic football helmet. John Riddell, Sr., was formerly the football coach and athletic director of a Chicago suburban high school, and spent considerable time experimenting on athletic equipment. One of his ideas was that better athletic padding could be made from a shell fastened to the player by a series of web suspensions that everywhere held the shell from the player so a blow could never be transmitted by direct contact. This is in contrast to the conventional method of load distribution by the use of sponge rubber, felt or other resilient material directly against the skin. By this method the distribution of the load can usually be brought to bear over a larger area and can frequently be removed from sensitive to less sensitive areas of the body. Since the shell is spaced from the body with an air passage between, there are many times the circulation for cooling that can be had from any number of holes through a pad against the skin.

The suspension is much lighter than an equivalent amount of padding and in general has a much lower storage capacity for perspiration; felt is the worst offender in this respect, picking up many times its own weight in moisture. Last, but not least, this type gives the greatest protection against those excessively hard blows that frequently cause severe injuries.

Having decided on the football headgear as the most logical article into which these ideas should first be tried, the problem then was the construction of a shell that would be lighter and tougher than the conventional. Headgears had formerly been built up of sole leather and more recently of leather and fiber, with some of fiber alone. They were formed over blocks or hot-pressed where necessary and assembled by sewing and riveting. If considerable care was not taken, they would lose their shape when wet and rough treatment invariably cracked the fiber reinforcing through the ventilation holes and the stitching.

Progress in manufacture of fiber impelled its consideration particularly since ventilation holes would not be present to weaken it. Aluminum and heavily filled leather were also tried. The fiber was too brittle and the edge did not finish well. The aluminum dented too easily or else was brittle and cracked. The filled leather lost its stiffness after repeated flexing and cracked readily when new.

Plastics were considered finally because of Mr. Riddell's previous experience and success in connection with their use for mechanical construction models. It was first thought that the shell could be molded in one piece, but since the shape was such that the core could not be withdrawn without a complicated construction, and the piece quite heavy, a two-piece construction was decided upon with the joint dividing the shell into right and left halves. A pair of experimental molds were made from bronze castings. It was assumed at first that the plastic would have to be reinforced with some other material either molded or fastened to the shell in some areas, but the first plain halves showed remarkable strength and shock resistance, opening the possibility of injecting them transparent and painting the inner surface where the paint could not be damaged rather than injecting them in the several school colors. The transparent material also offered the opportunity to use innumerable designs since the surface is smooth and unobstructed.

Some of the experiments with the first molds damaged them and shells made from their injections indicated for certain changes in design, so a second set was constructed more durable than the first. These molds were constructed to form a scarfed joint for cementing the two halves together, and a bead on the edge to make it smooth and less liable to cut the player.

It was desirable to find a (*Please turn to page 96*)

*On the bench (above) sturdy lightweight football helmets make their debut. Injection molded in two halves of transparent Tenite (left) and painted on the inside in college colors. Designed by John T. Riddell, Inc., they're molded by Sinko Tool & Mfg. Co. on an H-P-M 9-oz. hydraulic injection press*

*Tri-Luminar lamp incorporates a Bakelite phenolic housing for the oral illuminator and a Plaskon elongated shade for the fluorescent unit, and an indirect room light. Designed by Barnes & Reinecke in conjunction with Dr. Wm. A. Mendelsohn of Burton Mfg. Co., the lamp represents a significant advancement in illumination for dental work. Molding by Chicago Molded Products Corp. Below, at left, is the obsolete glass reflector*

# Triple threat to molars

**Three-in-one dental unit uses plastics for improved lighting and appearance**

LONG familiar to timid "dental cowards"—the terrifying overhead dental fixture with its bright glass bulbs can now be banished. A light that is practically glare-free, easy on the patient's eyes, now provides three-way light for dental work.

A single unit, it furnishes high intensity illumination within the mouth, fluorescent daylight illumination for matching the delicate shades of teeth and indirect room illumination to light his operating room. Plastics have been used to achieve the utmost in beauty and design for this triple-threat light.

Science has long established three fundamental factors which must be combined to create safe and efficient lighting. These three elements are: quantity, quality and distribution. Essential to the medical profession, the dentist in particular, lighting which lacks any of these three requisites is not only detrimental to his vision but to his work. Each year dentistry becomes more of an art. The matching of teeth, making bridge work and plates has stepped from the realm of pure, cold science into the field of artistry and craftsmanship, with the result that a maximum efficiency in lighting is required for perfect work.

Recognizing these demands, the Burton Mfg. Co. has produced a lamp which combines three separate units. The oral illuminator which provides a high intensity of soft, diffused illumination directly and deeply into the cavity, has a shade of molded phenolic plastic. The use of a plastic permits a beauty of design not possible with metal; in addition the light weight of the material assures easy placement and shade adjustment. A manufacturing economy was also gained through the elimination of finishing and assembling tasks. A heat- (*Please turn to page 104*)

# *Introducing*

# PRODUCT DEVELOPMENTS

A new section devoted to a case-history treatment of products that appear on the market from month to month. The purpose of this department is to tell, in words and pictures, a complete, yet concise story of items that are really brand new, or products that may be old but are now better or more economically produced because of plastics. There is not sufficient editorial space to cover all of the plastic merchandise that is constantly appearing on the market, but we try to do justice to as many products as possible through individual articles, the "Plastics In Review" pages and now, through Product Developments.

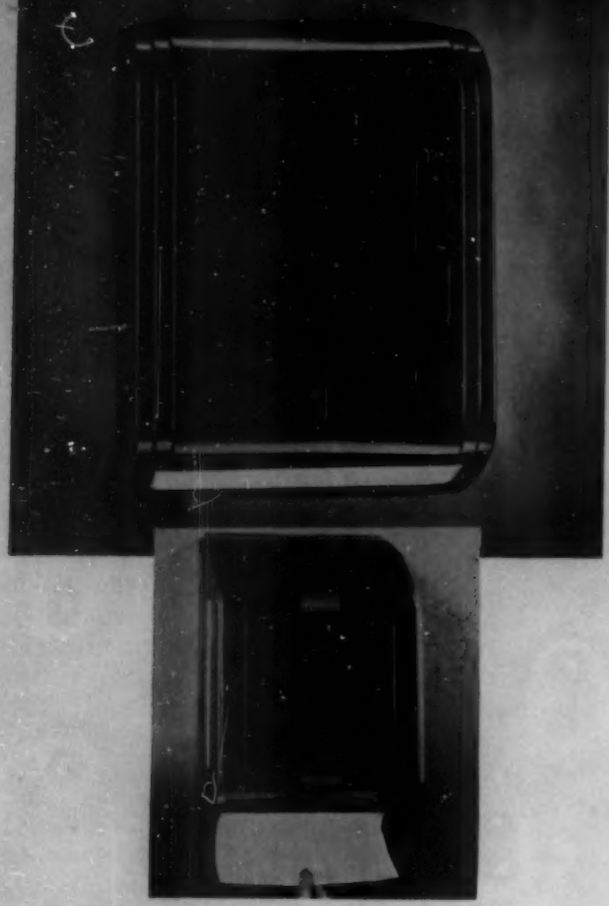
Our primary objective in introducing this new section is not simply to record what is being done in various fields of endeavor with plastics, but to assist our readers, many of whom may be encountering problems similar to those featured—which were solved by using plastics. In each case, we shall endeavor to show why plastics were selected for the job; perhaps, it will be because of economy or impact resistance, or resiliency, strength or ability to diffuse light, color fastness, or just good appearance. There are always reasons for choosing certain materials for a particular product, and in case histories these reasons are important.

We hope that these little stories will interest you. More information on any of the products mentioned and manufacturers' addresses may be obtained by sending a self-addressed stamped envelope to the editor.

## Arrow beam flashlight

Speed—in the economical method of manufacture, the simplicity of mechanical design, in the rapid assembly of parts—keynotes the production and styling of this modern flashlight. A total of 14 parts comprises the entire assembly and only *four* labor operations are required to complete the entire flashlight, exclusive of reflector assembly. Not a single eyelet or rivet is used in the assembly of body parts. Both top and bottom contact strips are fitted into grooves in the plastic case and the connecting strip is firmly attached by a double-locking, spring tension assembly device. Injection molding produces the various parts in large quantities with a minimum of waste and finishing operations. The body mold is 54 in. long to mold two flashlight bodies at a time and provides for a positive side draw of 8 in. for cores actuated automatically through rack and pinion by motion of the machine. Cycle rate is about two per minute. Molds for the other parts, such as the lens, lens cap, switch button, and lock button are all conventional multiple-cavity molds which operate at from two to four cycles per minute. Threads are accurately molded-in. Desirable safety features include: safety-off lock, prefocused lamp flare and signal device. Colors are permanent and the cellulose acetate case will not mar, chip or dent.

**Credits: Tenite, molded by Peerless Molded Plastics, Inc., for Fulton Mfg. Corp. on a 6-oz. Reed-Prentice injection machine. Speed nuts by Tinnerman Products, Inc.; Molds, Guy P. Harvey & Son**



# Towel dispensers

An exhaustive and careful search by a prominent manufacturer of tissue towels has resulted in two types of completely molded plastic towel dispensers that are attractive, durable and combine a delux appearance with utility. Plastics were chosen because they are inexpensive and their qualities satisfied exacting washroom requirements. First, the plastics will not rust or corrode. They are equally resistant to ordinary acids and alkalies; alcohol, hair tonic, antiseptics and other medications all wipe off without leaving tell-tale marks. Noninflammable, carelessly placed matches or cigarets offer no hazard as far as the dispensers are concerned. In fact, the streamlined design of the units makes it practically impossible to place lighted cigarets on them. Available in a rich black, the dispensers are all plastic which means that their color will not chip or wear off. A damp cloth is all that is necessary to clean them. Designed so as to prevent the accumulation of waste materials, the dispensers are made in two different types. One of these is a straight towel dispenser which holds 150 tissue towels. This unit has rounded edges and two attractive offsets extending down each side. The second contains a medicine cabinet with a mirrored door built on the front of the dispensing section and interior compartments.

**Credits: Bakelite and Resinox, molded by Boonton Molding Co. for Scott Paper Company**

# Hand lantern

Gone are the days of the kerosene lantern. Mrs. O'Leary's cow can now kick over a dozen "Twin-Bulb" electric hand lanterns and nary a spark will result. Equipped with two bulbs, this modern unit operates in such a way that the lighted bulb is always in the center of the large reflector. Designed for use on railroads, in oil fields and chemical plants as well as for general industrial use, the lantern has a non-breakable globe or lens molded of methyl methacrylate. The fact that this plastic is unaffected by petroleum or petroleum products was an important consideration in selecting the material. Because the bulbs project beyond the rim of the reflector, it was necessary to mold a convex globe with its outer face removed almost one inch above the rim where the globe fastens to the lantern. This shape was necessary in order that the bulbs can move freely under the globe and so that direct light from the bulb can be visible from all sides of the lantern. A two-cavity injection type mold was used. The fine finish of the mold assured perfect clarity and a smoothness of the transparent plastic lens. Developed at the suggestion of oil field engineers and approved by the United States Bureau of Mines, the lantern is safe for use in menthane and air mixtures. The all purpose, safety type lantern has a number of popular features. For instance, the handle of the lantern can be turned to any position around the lantern body. It can also be slipped over the arm.

**Credits: Lucite molded by Chicago Molded Products Corp. for Justrite Mfg. Company**

# Dolls

Always a perennial favorite with the children, dolls are one of the necessities of the nursery and playroom. No matter what the size or color, as long as the dolls are life-like in appearance, the youngsters love them. The models shown here are injection molded of cellulose acetate. It is claimed that this is the first time that the injection molding of the complete doll has been attempted, because, heretofore, such problems as heavy wall thicknesses and minute detail of facial characteristics were not successfully met. In these dolls there are molded sections up to $^1/_2$ in. thick. Reported to be superior than the models formerly made of wood pulp compositions, these solid cellulose acetate dolls are practically unbreakable. Smooth and pleasant to the touch, they are safe for the children to handle. Vegetable colored paints are used to give the proper coloring to the hair, eyes and other features. These paints are non-poisonous and are applied by hand. It is claimed that the adherence is good and the colors will not rub off. The dolls are also dressed by hand and their little clothes are fastened securely to the bodies. The baby in the long dress measures about 2 1/4 in.; the little boy is about 3 3/4 in. long, while the girl stands about $3^1/_2$ inches. There are two more dolls to be added to the line which will make a complete set of five. Rather paradoxically, perhaps, the mother and father are now being molded so as to make up a complete family. Although these dolls are copies of cheaper models, their superiority of construction and appearance relegates them for sale in the better department stores and toy shops.

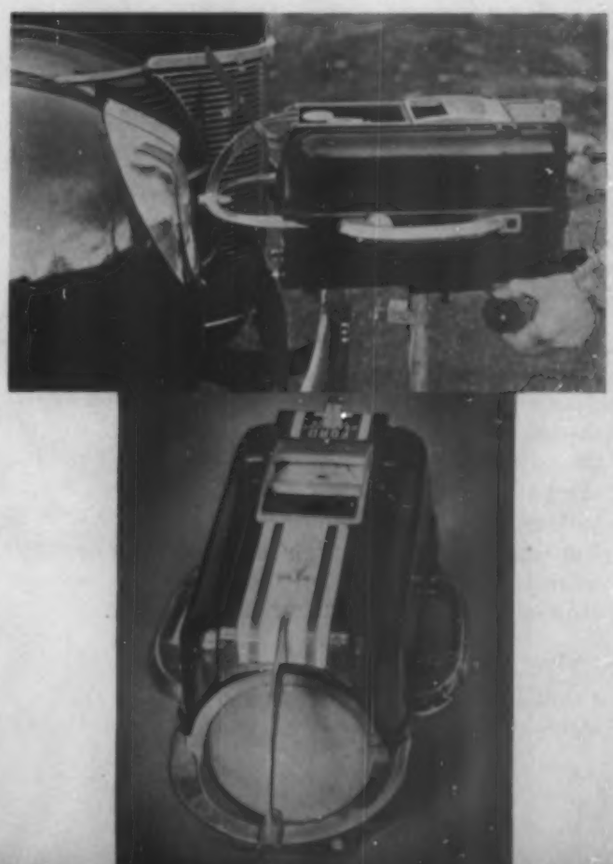
Copper beryllium molds are being employed in making the dolls.

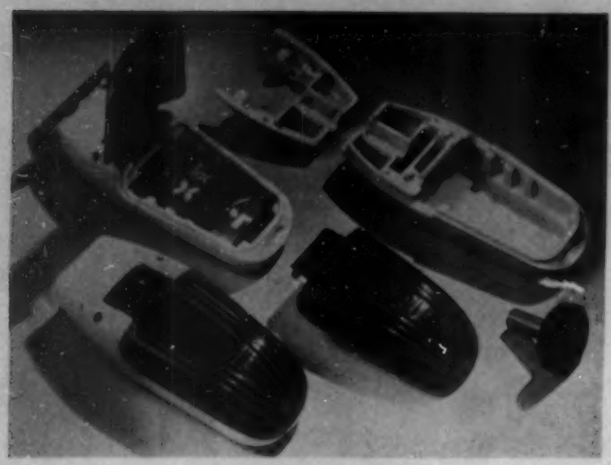
**Credits: Lumarith and Plastacele molded by Universal Plastics Corp. for F. & B. Doll Co. Tools by Perfect Doll Mold Company**

# Headlight tester

With highway safety a major consideration for night drivers, service station operations have added headlight checking to increase sales volume. Limited space, and even more limited time makes bulky, complex, inaccessible equipment impractical. A compact, plastic-housed tester unit does the job quickly and accurately in no more time than it takes to wipe a windshield. Requiring only two feet of space, the tester may be used for two-minute checking inside or outside or in the service station driveway or even on the curb—wherever there is a front clearance of two feet. It is no longer necessary to shift cars or provide wall curtains to make headlight tests. All the equipment—slope, compensator, level gage, beam condensing lens, aim scale, miniature series and candle-power meter are enclosed in the self-insulating phenolic case. The unit may be used to check and adjust vertical and horizontal beams, check beam candle power, and by placing it on a small stand which contains a leveling adjustment, it may be used for adjusting beam aim at point of check. Fine adjusting, which is extremely accurate, can be done within a few minutes' time, and the customer can plainly see the results of the adjustment on the dial at top. Well-balanced, lightweight, easy to operate, the unit is said to be 30 to 40 percent lower in price than for other equipment of this type. Plastic housing has rounded corners and edges.

**Credits: Molded of Bakelite for Heyer Products Co. by General Electric Co.'s Plastics Department**





# Shaver ensemble

The Cooper "Carryall" will soon appear in drug stores and on notion counters as an up-to-date and modern rendition of the out-moded razor. The problems facing the designers included the matter of profit for the razor manufacturer as well as the blade manufacturer; and with that, they turned to plastics. They found that during the past few years, the razor had become no more than a "give-away" article often used merely as a stimulus for sales of particular blade manufacturers. In considering rejuvenation for this prosaic article that had lost its sales glamour, they searched for new merchandising features to charm the buyer even if he has one or more razors. It was finally agreed that a hidden and protected razor, as many blades as possible, and a handle all included in one compact, attractive, easily manipulated unit would solve the problem. Clay models were made and some semblance of the final design emerged in a handle that served as a "carryall" for the razor and ten blades—hence the name. The problem of "grip" due to soap and water usage which renders the item slippery to the touch, was solved by grooves placed on the bottom and an embossed design embodying the name on the top. The materials decided upon were urea and phenol because of the conditions to which the article would be subjected. There are four separate plastic parts. A brass sleeve was inserted in the knurled knob and the two snap-on front sections were augmented by two brass studs for a permanent bond. A hinge for the lid without the customary hinge-pin was developed; this lent itself to easy assembly and became permanent when the two brass studs were entered. A two-tone color combination of maroon and cream was selected.

**Credits: Designer, Martial & Scull; Bakelite, Beetle, Durez and Resinox molded by Joseph Stokes Rubber Co.**

# Chums

Tiny animals, coffee pots, bugles, etc., etc.—make up a novel assortment for "make-up-your-own" jewelry. They're called "Chums" not "Charms" and it must be because the three dimensional little plastic miniatures are so companionable. At any rate the pieces are injection molded of cellulose acetate, 50 at a time. A jeweler built the intricate mold which accounts for the meticulous engraving and fine, realistic, detail-work—with warts on the toad, scales on the fish, feathers on the birds, and even a slate on which that bewitching declaration, "I love you," is clearly visible. The chap who thought up the idea is not a molder. He enjoys life! Chums were this gentleman's brain child, but now they are available in 50 different designs from a stock mold. Eminently suitable for chain store sales, premiums, necklaces, bracelets, dressmakers' and milliners' trim, anything except chewing gum manufacturers' gadgets, the figures can be had in an almost unlimited range of bright colors that are permanent, smooth and washable. Mix them or match them might be the motto for these miniatures. Those who like variety can make up a bracelet or necklace that will run the gamut of violins to seals. A particularly domestive type of person might like a set of kitchen utensils—the kind that always remain bright and shiny. Chums are ideal for children's bracelets, since the color will not come off. Those who like dangling jewelry will appreciate these noiseless charms.

**Credits: Tenite, injection molded by American Insulator Corporation**

# Continuous length extrusion

by JAMES E. PIERCE*

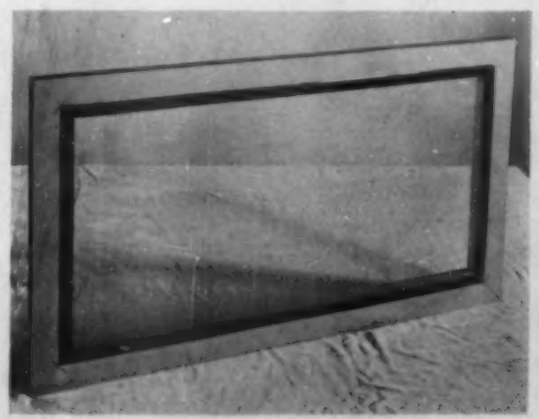
**Extruded plastics of various types continue to gain in importance and application**

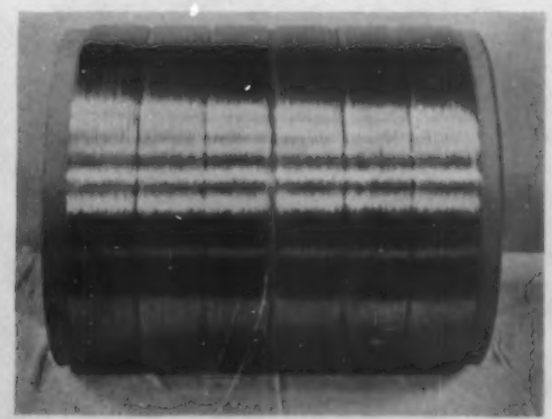
CONTINUOUS length extrusion is rapidly gaining a place of more prominence and importance in the plastics industry. New equipment is being developed and applications seem to multiply almost as quickly as the material is produced. Vinylidene chloride, acetate butyrate, ethocellulose and cellulose nitrate are being extruded with widely divergent applications in numerous fields.

The foremost use for small gage diameters of vinylidene chloride thus far has been in fishing tackle. Plastics strands in this form are distributed in coils and cut to lengths for leaders, trolling lines and snells. Compared with Japanese synthetic gut, the extruded material has several important advantages. First, it does not have to be soaked in order to attain proper flexibility. Water does not lessen its strength, nor does it fray and become weak with continued use. Knots must, of course, be tied with care, but very few fishermen have trouble with this type of line unless they are the kind who like to snap their fly as a whip is snapped. Admittedly, the plastic will not stand up under this strain as well as the more expensive silkworm gut.

A rather unique form of twisted cordage made of this same plastic is to be used for snells and leaders for salt water fishing. This particular construction is made in three, four and six filament cords, giving a more flexible line than the single filament. In a soft twist, this tends to unravel on cutting the ends, while the hard twist will not unravel. It (*Please turn to page 102*)

* President, Pierce Plastics, Inc.





*Extruded plastics in various gages and forms are finding their way into widely divergent fields. Upper left-hand corner shows one of the experimental fly screens, below that is a bolt of extruded plastic in tape form. Fine gage and twisted cordage types are also finding their way into specialized fields. These samples are vinylidene chloride extended by Pierce Plastics, Inc.*

*Floats for the commercial fishing business are molded in 2 different sizes, 3 in. by 8 in. and 1⅝ in. by 5 in. of Tenite by J. H. Shepherd Son and Co. Replacing wood, aluminum and cork, the floats are available in an unlimited color range. Plastic needles for threading floats and repairing nets are tough and sturdy*

# Fishing is a business

**Lightweight, sturdy floats and needles aid commercial fishermen by giving longer and better service**

ALONG the Atlantic Coast near the New Jersey shore and throughout the Great Lakes, brightly colored plastic floats appear in commercial fishing waters used to support large nets. The floats are injection molded of cellulose acetate. There are two sizes, 3 in. by 8 in. and $1^5/_8$ in. by 5 inches. As the demand for other sizes increases, it is expected that additions will be made to the line. The range of colors possible is virtually unlimited. Each float is made in two parts. One half is open; the other is closed by a thin plastic disk which forms the center of the float. Molded-in extensions at both ends have ample room through which the thick twine may be run and knotted firmly into place.

The small float, as seen in the color photograph, is a gill net float used on gill nets in the Great Lakes, replacing the wood and aluminum type. The wood float is reported to have cost 25 percent less than the plastic float, but the fact that the wood is porous, thus requiring a preservative twice a year, makes the cost about equal after approximately two years' service. The wood float gradually absorbs water while in service, letting the net sag and necessitates removing the net periodically to dry out the floats. The plastic float maintains its buoyancy indefinitely.

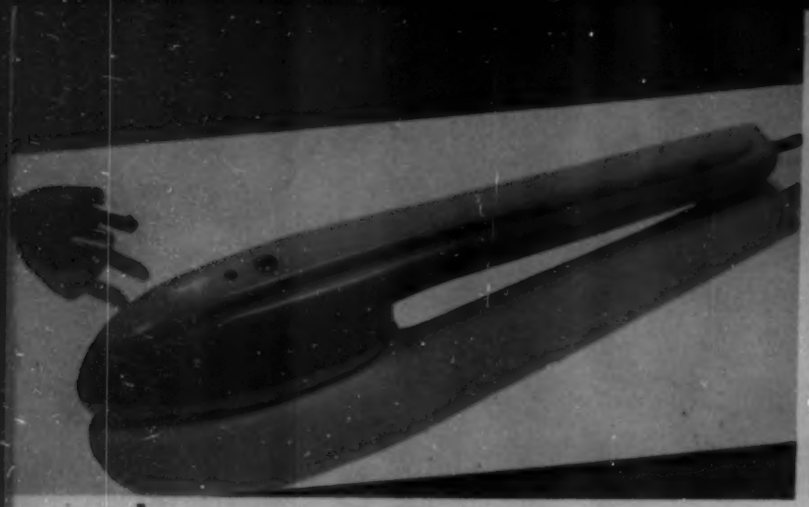
The aluminum gill net float is made in several price ranges and the cheapest type costs about 25 percent more than the plastic gill net float. Floats made of aluminum are much harder to connect to the net as no provisions are made for tying them on. The plastic type is provided with two pierced projections for this purpose. Aluminum floats have a hard surface and often damage the net in handling. This is done by bumping the fine twine with the floats against the side of the boat or the fishing gear. The plastic floats are said to be 15 percent lighter than the aluminum. Since the plastic is resilient, the plastic models are less apt to damage the twine through handling.

On purse seining nets and nets used in the Atlantic Ocean, the large plastic floats are used. In this instance, the plastic replaces cork which was formerly imported from Spain. Because of war conditions, the cork has been difficult to obtain, so it was necessary to look elsewhere for another material. Although when comparing initial costs it is apparent that the plastic seining float costs about 10 percent more than the cork, the savings on maintenance as a result of the durability of the plastic model overrides this. The cork not only absorbs water and allows the net to sag below the surface thus letting the fish swim over, but cork sloughs off which causes a gradual decrease in size and buoyancy of the float. The plastic floats resist the chafing found in this type of fishing and retain their buoyancy.

Fishermen also use needles in their trade. They buy their twine already knitted in different-sized meshes from threads of various sizes. This twine is assembled by the fishermen themselves using needles to attach the rope which reinforces the nets. These needles, which are now being made of the same plastic, are also used in mending the nets when damaged in storms or in handling. Needles have been made of hard rubber, wood and aluminum, but those of hard rubber were quite brittle and easily broken. Besides, the tongue was usually short and too sharp. Those of wood were subject to splitting while those made of aluminum cut the thread in pulling the knots tight.

The fact that the plastic material used is tough and resilient adds to the life of the floats and the needles. With no surface finish or soft top layers to wear, these fishermen's devices are doing a superior job.

***Transparent models show hollow construction with flat disk that fits over one end before large sections are cemented together. Twine is threaded through appendage at either end***



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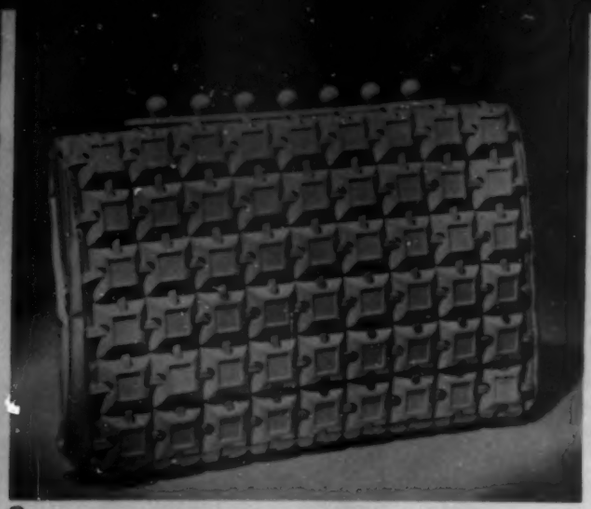

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# PLASTICS IN REVIEW

1 It's called the Viva-Glo Massage Master and was designed by R. Thur Schmidt & Associates. The Durez housing has a high polish finish that will not wear off. Clean, neat and sanitary, the instrument is well insulated while the plastic protects the user from any electrical shock. Designed for utility, its sturdiness is well camouflaged by attractive lines. The heat-resistant plastic holds its shape and will not warp. Molded for Mardi Mfg. Co. by Imperial Molded Products Corporation

2 Unique in design and wonderful in wear, this handbag is covered with a myriad of dainty squares molded of Monsanto cellulose acetate. Available in a wide range of colors, the plastic bag can be cleaned with a damp cloth. The squares are held together by criss-crossing straps, and are molded by Consolidated Molded Products for L. Appel & Co. It is lightweight and comfortable to carry

3 There is no magic here, but there are a few thick sheets of Plexiglas supporting this concert grand Wurlitzer piano. A decided innovation in the piano field, the case seems to be suspended in mid-air. The strength of the plastic guarantees safety, while the sparkle and brilliance add a new charm to an old instrument. The plastic sheets form a solid foundation and in no way impair the tone

4 Self-contained, plastic-lensed navigation lights are not bothered by hail storms, hurricanes nor the dark of night. Dry-cell batteries, fully enclosed and protected, insure service regardless of power supply. The lenses are molded in red and green Monsanto polystyrene and are unaffected by brine, moisture or sunlight. Metal fin directs the beams from the two lights. Molded by Owens-Illinois Glass Co. for Delta Electric Co.

5 Fully automatic coffee maker eliminates certain disadvantages generally experienced by coffee makers. Small amounts of coffee can be brewed without sacrificing strength or quality. The device also keeps the coffee at a desirable temperature until serving time. Base has molded-in scratch-proof feet, and upper and lower bowl handles are cool, with finger grooves and right- and left-hand thumb rests. Plastic cap keeps brew hotter and prevents loss from steaming. Decanter cap and base are molded of Textolite by General Electric Company

6 Conservative in design, this Westinghouse International Electric radio has a molded plastic housing in mottled brown. Designed for possible exportation, the radio has a dial with the various wave length bands for South American countries, Mexico, London, Rome, Paris and Berlin as well as the United States. The simplicity of the lines with the recessed front make the model adaptable to practically any interior. Molded by Bryant Electric Co. of Bakelite and Durez, the model was designed by Frederic S. Grover

7 Aircraft oxygen flowmeter is lightweight and accurate. The tapered tube and the window are molded of Lucite with the gradation marks an integral part of the rear surface. Buoyant red float is of the same plastic. An incandescent bulb provides illumination. Molded by Elmer E. Mills Corp. for the Gaertner Scientific Corporation

8 Serata is an all purpose, non-porous, odorless knife that will not tarnish or stain. Requiring no pressure when used, the knife is moved lightly back and forth like a saw over the object to be cut. Fresh cake, bread, vegetables and fruits can be cut without dulling the knife. Made of Catalin by Edgar Weil Company

9 Smooth, lustrous and conservative in design, these door chimes have been made functionally correct by the use of a plastic case and back plates which serve to refine and better the tone. Molded Plaskon cases in white, gray and blue harmonize with chrome tone tubes, while brown Textolite blends with tubes of brushed brass. Molded by General Electric Co. with collaborative design work by Gorham Co. and the Mello-Chime and Signal Company

10 The use of molded Lumarith end plates for insertion in coil housings allows a breakdown of about 8000 volts and eliminates hand taping of the coil. By employing a plastic a very desirable type of service lead anchorage is made possible, in addition to a fine finish. Molded by Chicago Molded Products Co. for Sangamo Electric Company

11 Now you can write in the dark. Pencilite is a mechanical pencil that has a transparent Tenite part tapering toward the point and permitting light from a concealed bulb within the barrel to illuminate the paper. It's a handy size too. Molded for Allbright Electric Corp. by Jos. Stokes Rubber Company

12 Both the astute host and Mike behind the bar dote on liquor pourers that waste nary a drop of the precious liquid. Green River believes that one good turn deserves another, so their pourer is designed like a miniature bottle. Molded of brown Bakelite polystyrene by Plastics, Inc., for Oldetyme Distillers Corp., the device will take a lot of punishment and still look like new

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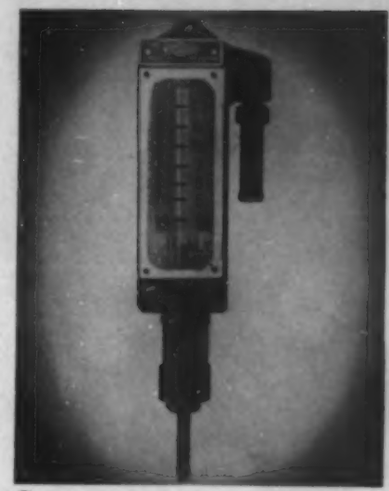

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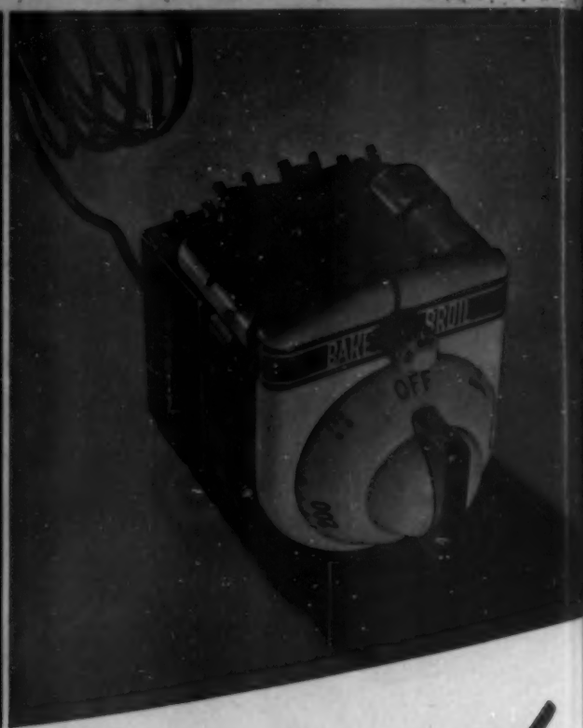



# Prize-Winners!.. Achieved

# *with* PLASKON MOLDED COLOR

**Again** the advantages of Plaskon for eye-catching design and efficient manufacture have been proved!

The awards in the 1940 Annual Modern Plastics Competition include a generous listing of distinctive products molded from colorful Plaskon. In a wide variety of shapes and sizes, these prize-winners impressively demonstrate that Plaskon has few limitations when modern design and striking beauty are "must" specifications.

Why are utility and luxury items of Plaskon Molded Color so outstanding in sales and production advantages?

Plaskon colors . . . rich, warm and decorative . . . are major factors in influencing buyers' choice. And these glowing colors are permanent, non-fading, for they are *solid color* through and through.

Light weight, combined with great strength, permit unusual design without sacrificing service. Hard blows won't chip or dent it.

Plaskon Molded Color has a lustrous surface, smooth, hard, non-porous, and easy to clean. Can't be scratched or stained, and won't corrode, rust, or tarnish.

Why not put *your* products into the prize-winning class with Plaskon Molded Color? Plaskon may be adaptable to your present molding schedule, or can be adapted with reasonable changes. We shall be glad to give you the benefit of our technical experience . . . a letter or wire will bring a capable Plaskon representative to your plant. Plaskon Company, Incorporated, 2121 Sylvan Ave., Toledo, Ohio; *Canadian Agent:* Canadian Industries, Limited, Montreal, P. Q.

## THE WINNERS!

The Awards made to Plaskon-molded articles in the 1940 Modern Plastics Competition are as follows:

In the Lighting Group, Top Award to John C. Virden Co., Cleveland, Ohio, for the Fluorogrill Fluorescent Fixture shown above. Molded by Plastics Department, General Electric Co., Pittsfield, Mass.

In the Industrial Group, Honorable Mention to the Wilcolator Company, Newark, N. J., for the Oven Selector Switch shown at left above. Molded by Consolidated Molded Products Corp., Scranton, Pa.

In the Business and Office Equipment Group, Honorable Mention to the Zephyr American Corp., New York City, for the Rollodex, Thermodex and Telephone Index units shown at left above. Molded by Universal Plastics Corp., New Brunswick, N. J.

In the Communications Group, Top Award to General Electric Company, Bridgeport, Conn., for the G-E Model 501W Radio shown at left below. Molded by Plastics Division, General Electric Company, Meriden, Conn.

Trade Mark Registered

# PLASKON

★ MOLDED COLOR ★

# Plastic materials census data: 1939*

MANUFACTURERS of plastic materials reported a moderate increase in production, a slight increase in wages, and a slight decrease in wage earners for 1939 as compared with 1937, according to preliminary figures compiled from returns of Census of Manufacturers for 1939 and released by Director William Lane Austin, Bureau of the Census, Dept. of Commerce.

This industry, as constituted for census purposes, includes establishments primarily engaged in the manufacture of plastic materials and synthetic resins such as casein, cellulose acetate, nitrocellulose phenolics, etc.

The value of products of the industry for 1939 amounted to $77,653,314, exceeding by 16 percent the $66,955,407 reported for 1937.

The 1939 Census of Manufactures is the first census for which employees of plastic materials manufacturing plants who were primarily engaged in distribution, construction, etc., activities have been called for separately on the schedules. It is not known how many of the wage earners reported for 1937 were engaged in distribution and construction and how many were engaged in manufacturing. Employees of the plants reported as engaged in distribution and construction activities in 1939 are not included in this preliminary report but will be included in the final report.

The wage earners primarily engaged in manufacturing in this industry in 1939 numbered 6966, a decrease of 4.4 percent as compared with 7283 reported for 1937, and their wages, $9,839,935, exceeded the 1937 figure, $9,481,773, by 3.8 percent.

Summary statistics for 1939 and 1937 are given in Table I. Detailed statistics on production are given in Table 2. All figures for 1939 are preliminary and subject to revision.

TABLE 1.—SUMMARY FOR THE INDUSTRY: 1939 AND 1937

(Because they account for a negligible portion of the national output, plants with annual production valued at less than $5000 have been excluded since 1919)

| | 1939 | 1937 | Percent of Increase or Decrease (−) |
|---|---|---|---|
| Number of establishments | 38 | 34 | [5] |
| Salaried personnel[1] | 2,061 | 1,635 | 26.1 |
| Salaries[1,2] | $ 4,757,869 | $ 4,304,570 | 10.5 |
| Wage earners (average for the year)[3] | 6,966 | 7,283 | −4.4 |
| Wages[3,4] | $ 9,839,935 | $ 9,481,773 | 3.8 |
| Cost of materials, supplies, fuel, purchased electric energy, and contract work[4] | $40,563,524 | $35,713,142 | 13.6 |
| Value of products[4] | $77,653,314 | $66,955,407 | 16.0 |
| Value added by manufacture[4] | $37,089,790 | $31,242,265 | 18.7 |

* The complete text of this preliminary report on plastics materials is published here by special permission of Virgil D. Reed, Director of the 16th Census of the United States, 1940.

[1] No data for employees of central administrative offices are included.

[2] Profits or losses cannot be calculated from the census figures because no data are collected for certain expense items, such as interest, rent, depreciation, taxes, insurance and advertising.

[3] The item for wage earners is an average of the numbers reported for the several months of the year and includes both full-time and part-time workers. The quotient obtained by dividing the amount of wages by the average number of wage earners should not, therefore, be accepted as representing the average wage received by full-time wage earners.

[4] Value of products less cost of materials, supplies, fuel, purchased electric energy and contract work.

[5] Percent not computed where base is less than 100.

TABLE 2.—PRODUCTS BY KIND, QUANTITY, AND VALUE: 1939 AND 1937

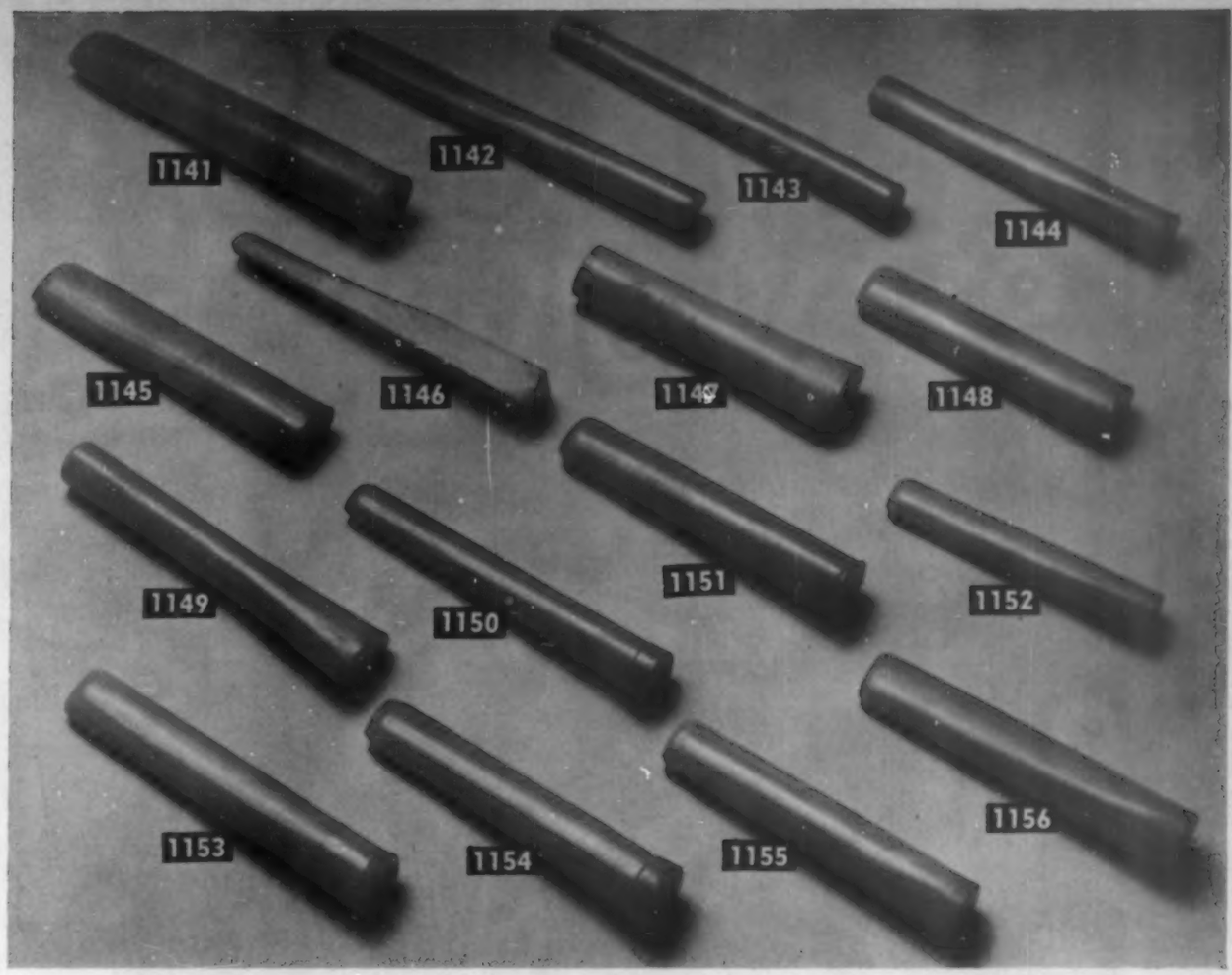
(Data for the production of wrapping materials are not included)

| | 1939 | 1937 |
|---|---|---|
| 1. Plastic materials industry, all products, total value | $77,653,314 | $66,955,407 |
| 2. Plastic materials | 63,054,576 | 52,417,797 |
| 3. Other products (not classified in this industry) | 14,598,738 | 14,537,610 |
| 4. Plastic materials made as secondary products in other industries | 16,698,234 | 9,459,893 |
| Plastic materials, aggregate value (sum of 2 and 4) | $79,752,810 | $61,877,690 |
| Nitrocellulose (pyroxylin) sheets, rods, and tubes: | | |
| Number of establishments | 10 | 11 |
| Total production, not including finished articles, pounds | 13,357,116 | 18,122,788 |
| Made and consumed, pounds | 2,149,479 | 3,271,971 |
| Produced for sale: | | |
| Pounds | 11,207,637 | 14,850,817 |
| Value | $8,495,519 | $12,526,206 |
| Cellulose acetate: | | |
| Sheets, rods and tubes, not including finished articles: | | |
| Number of establishments | 7 | 6 |
| Pounds | 8,743,139 | 18,923,663 |
| Value | $6,588,247 | $12,199,744 |
| Molding composition: | | |
| Number of establishments | 7 | [1] |
| Pounds | 11,537,032 | [1] |
| Value | $5,222,946 | [1] |
| Coal-tar resins: | | |
| Number of establishments | 32 | 30 |
| Total pounds | 152,121,989 | 131,568,162 |
| Total value | $29,406,947 | $22,583,627 |
| Other plastics and synthetic resins, including synthetic rubber, value[2] | $30,039,151 | $13,568,113[3] |

[1] No data.

[2] Includes photographic-film base, rubber substitutes and ethyl cellulose.

[3] Revised.




# Cast Resin Forms

## SHEET ONE HUNDRED-ONE

**Rough cast resin shapes, designed for pipe stems or cigaret holders, are available from stock, in attractive colors ready to be drilled, buffed and finished, for assembly. Names of molders will be supplied on request**

---

**1141.** Pipe bit, 3 7/8 in. long. Round shape 0.650 in. in diameter at large end. 20 pieces to the pound

**1142.** Pipe bit, 4 5/16 in. long. Round shape 0.450 in. in diameter at large end. 39 pieces to the pound

**1143.** Pipe bit, 4 in. long 0.400 in. square at large end. 48 pieces to the pound

**1144.** Pipe bit, 3 1/4 in. long. Round shape 0.455 in. in diameter at large end. 49 pieces to the pound

**1145.** Pipe bit, 3 1/4 in. long. Oval shape 0.450 in. by 0.615 in. at large end. 37 pieces to the pound

**1146.** Pipe bit, 3 1/2 in. long. 0.420 in. square at large end. 46 pieces to the pound

**1147.** Pipe bit, 2 3/4 in. long. Oval shape 0.490 in. by 0.735 in. at large end. 34 pieces to the pound

**1148.** Pipe bit, 2 11/16 in. long. Oval shape 0.435 in. by 0.600 in. at large end. 48 pieces to the pound

**1149.** Pipe bit, 3 7/16 in. long. Oval shape 0.460 in. by 0.665 in. at large end. 36 pieces to the pound

**1150.** Pipe bit, 3 5/16 in. long. Round shape 0.485 in. in diameter at large end. 45 pieces to the pound

**1151.** Pipe bit, 3 in. long. Round shape 0.540 in. in diameter at large end. 38 pieces to the pound

**1152.** Pipe bit, 2 1/2 in. long. Round shape 0.410 in. in diameter at large end. 70 pieces to the pound

**1153.** Pipe bit, 3 1/4 in. long. Round shape 0.520 in. in diameter at large end. 38 pieces to the pound

**1154.** Pipe bit, 3 in. long. Round shape 0.565 in. in diameter at large end. 42 pieces to the pound

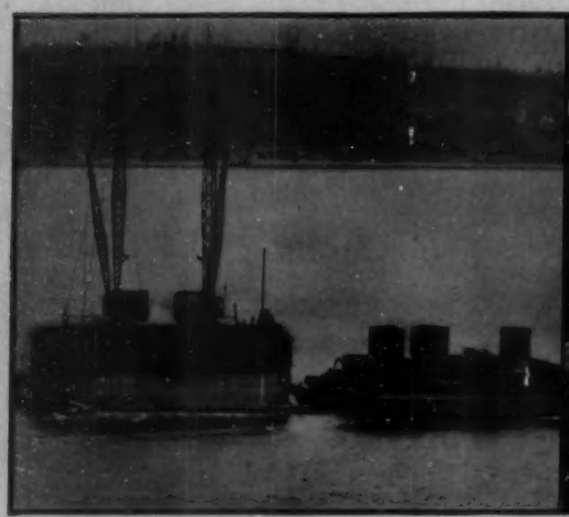
**1155.** Pipe bit, 2 13/16 in. long. Round shape 0.505 in. in diameter at large end. 46 pieces to the pound

**1156.** Pipe bit, 2 15/16 in. long. Round shape 0.530 in. in diameter at large end. 40 pieces to the pound

**Address all inquiries to Stock Mold Dept., Modern Plastics, Chanin Building, New York, giving item and sheet numbers**

# DUREZ-BONDED PLYWOOD SCORES NEW TRIUMPH!

*Plywood concrete forms still usable after 93 days of salt water submersion on Tacoma Bridge Project!*



**One of the** 216-foot concrete piers, showing assembled plywood forms for pouring concrete cells used in building the piers.

**The Narrows Bridge** across Puget Sound at Tacoma, Wash., will look like this when complete —with the aid of Durez-bonded plywood.

**Section cut from** Resnprest plywood form, after 93 days of continuous salt water submersion.

THE MULTIPLE RE-USE of Durez resin-bonded plywood has just been dramatically demonstrated on the Narrows Bridge project on Puget Sound, near Tacoma, Wash.

Two carloads of Resnprest plywood panels, bonded with Durez resin glue, were used to build the concrete molding forms for the huge bridge piers. The sides of the forms were bolted together, the concrete poured and allowed to set for three days. The operation was repeated every five days until the piers were finished.

In this rigorous service the plywood forms were used 15 times. They were constantly submerged in salt water for 93 days. But that wasn't all. After the job was complete, the forms were placed face up in the weather for 90 days more. Apart from slight surface checking due to sun exposure, the Durez resin-bonded panels showed practically no wear, and could have been used many more times!

Here is another striking example of the way Durez resin-bonded plywood is helping to improve construction methods and reduce costs. For more information about this interesting new development write—

DUREZ PLASTICS & CHEMICALS, INC.
591 WALCK ROAD NORTH TONAWANDA, N. Y.

**DUREZ PLASTICS & CHEMICALS, INC.**

PLASTICS THAT FIT THE JOB

# Curing phenol resins with metal chlorides

by LAWRENCE E. STOUT and CHARLES R. McALISTER, Jr.*

THE phenol-formaldehyde resinous material described in the original Baekeland patent[1] required from several days to weeks to harden to an infusible mass at temperatures below the boiling point of water. At higher temperatures and with increased pressure, this was reduced to a minimum of fifteen to thirty minutes, the time depending on the degree of polymerization which had taken place during the original condensation period.

Considerable work has been done to find catalysts of all types to expedite the original condensation period of the two-stage resins and the molding or curing period of these phenol-formaldehyde plastics. No reference was found in the literature to the specific use of metallic chlorides as catalysts for this latter period, but a patent granted to Miles[2] for the use of stannous chloride as a condensing agent for a one-stage phenol-formaldehyde resin is of some interest. The patent gives no specific data but states that the stannous chloride acts as a catalyst and cooling of the reaction mixture is required to prevent a too rapid condensation.

The general procedure followed during the course of this investigation consisted of making up batches of phenol-formaldehyde resin according to a standard formula, each time endeavoring to make the product precisely the same in all respects. This resin or molding powder was then tested to determine the time required for the proper curing of the untreated resin. This proper curing time was arbitrarily chosen as that time required to develop the maximum strength in the molded product without any scorching or burning. The strength of the resin was determined by means of a lever arrangement operating on the principle of the bend test described by Ellis.[3] The bending and breaking force was measured to the nearest 100 grams by placing brass weights in a container suspended from the end of the lever arm of the testing device, as shown in Fig. 1. As in the original condensation procedure, great care was taken to ensure that conditions were comparable for all tests. After each batch of resin had been suitably standardized, the material being examined for catalytic properties was added to the resin composition in proportions of 5, 10, 15, and 20 percent by weight, and the proper curing time was determined as before. In all cases, pressure and temperature were maintained constant.

The following specific procedure was followed for making the resin using phenol and formaldehyde in equimolecular proportions. One hundred parts by weight of phenol, 86 parts by weight of formaldehyde (37 percent) or 31 parts by weight of paraformaldehyde, and 27 parts by weight of ammonium hydroxide of specific gravity 0.9 were placed in a large round-bottom flask and gently refluxed for exactly twenty minutes. The resin appeared as a thick viscous layer. The contents of the flask were quickly poured into cold tap water (about 55 deg. F.) and thoroughly washed about ten times with tap water. The resin was obtained in the form of a yellow mass, soluble in acetone, but insoluble in water. This mass was heated gently to distill out the excess moisture. This step was later

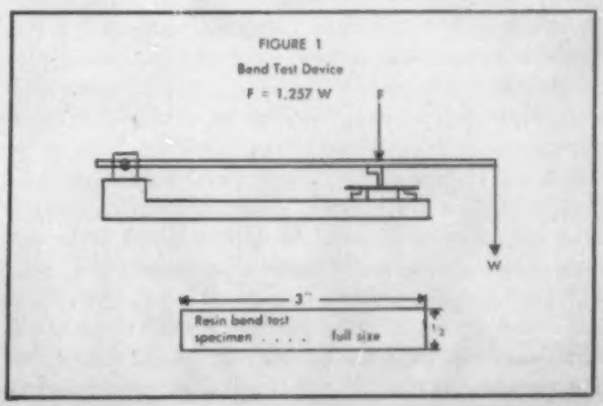
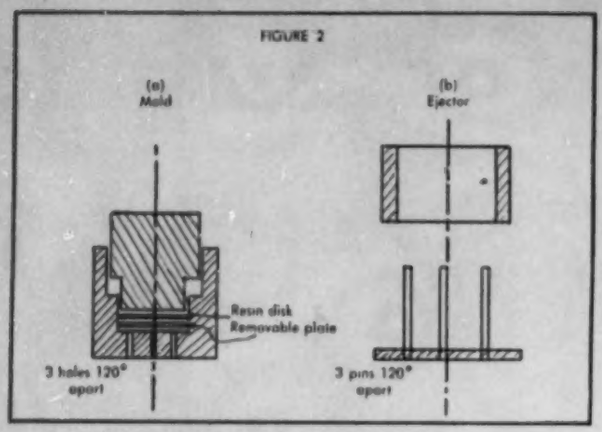



FIGURE 1
Bend Test Device

* Washington University, St. Louis, Mo.
[1] U. S. Patent 942,809 (December 7, 1909).
[2] U. S. Patent 1,549,888 (August 18, 1925).
[3] Ellis, "The Chemistry of Synthetic Resins," Volume II, p. 1341; Reinhold Publishing Co., New York, N. Y. (1935).




MOLD FOR MAKING TEST DISK

deleted, as mentioned below. The resin was then weighed and dissolved in sufficient acetone to give a solution of approximately the same viscosity as a light varnish and poured onto and thoroughly mixed with woodflour (200 mesh), the weight of which was 65 percent of the weight of the resin. (Note modification below.) This impregnated woodflour was then spread out in a thin layer and allowed to dry in the air. When dry, it was reduced to a fine powder and weighed. Finely powdered hexamethylenetetramine to the extent of 15 percent of the weight of the resin-woodflour powder was mixed with it with great care. (Note modification below.) An appropriate weight (40 g. in this case) of the molding powder was placed in a chromium-plated case-hardened steel mold designed to produce a flat uniform disk (Fig. 2). The mold was maintained at a temperature of 325 deg. F. for at least 20 minutes before the powder was placed in it, and all molding was done at this temperature. The pressure of molding was held constant at 3500 lb. throughout the investigation. After suitable time had been allowed for proper molding, the disk was discharged from the mold, allowed to cool to room temperature, and sawed into strips of the proper size for the bend test. The curing time for the resin was taken as that at which the greatest strength was produced without any scorching of the disk.

As the investigation proceeded, a number of improvements in the procedure were developed.

(1) It was found that paraformaldehyde did not produce as satisfactory a product as the aqueous formaldehyde solution, and, in addition, the aqueous solution was much more easily handled. Therefore, aqueous formaldehyde was used in all the tests upon which conclusions regarding rate of cure were based.

(2) Distilling the excess moisture from the yellow resinous material after washing was found to be unnecessary. Therefore it was discontinued.

(3) Experiment showed that soaking the woodflour with acetone materially reduced the mechanical difficulties of obtaining a complete mixing and a thorough impregnation with the resin solution. A saving in time was achieved by drying the pasty mixture in a vacuum drier rather than depending on air drying.

(4) By careful control, a McCool disk-type pulverizer may be used to powder the resin. This procedure materially decreased the labor and time of grinding the molding powder. Care must be taken, however, that a sufficient temperature rise is not produced during the grinding to cause partial polymerization of the resin. The resin may be ground to about 100 mesh in one pass by slow feeding, never permitting the grinding faces to become clogged. A second pass almost invariably caused polymerization resulting in the *freezing* of the pulverizer. The hexamethylenetetramine may also be advantageously ground in the McCool pulverizer, about 200 mesh being desirable, even finer if possible.

(5) Mixing of the powdered resin with the finely ground hexamethylenetetramine was accomplished fairly well by rolling in a small ball mill for 8 hours, but better distribution was obtained by impregnating the woodflour with a water solution of the hexamethylenetetramine. The resulting heavy paste was dried in a vacuum drier.

(6) The 40-gram sample used in the mold was satisfactorily reduced to 30 grams, thus economizing on the molding powder and reducing the number of condensations and standardizations.

(7) In preparing the samples containing the chlorides, it was found also that the most satisfactory method for ensuring even distribution of the salt throughout the mixture was to impregnate the woodflour with an aqueous solution of the chloride and then dry the impregnated flour before soaking it with acetone preparatory to mixing with the solution of the resin.

The data and results of this investigation are arranged chronologically according to the batch number of the condensation producing the standard resin being examined. All moldings were made at 325 deg. F. and 3500 lbs. gage pressure.

Condensation No. 1: A 1-mol batch of the resin was made, using paraformaldehyde in place of the aqueous formaldehyde solution. Resin was very gummy and never dried properly. Discarded.

Condensation No. 2: A 1-mol batch made with aqueous formaldehyde solution. Dried resin was ground successfully by one pass through the McCool pulverizer, but an attempt at a second pass resulted in the polymerization of the resin, which effectively cemented together the faces of the pulverizer. Hexamethylenetetramine was ground in a mortar and was mixed with the resin by hand. Grinding and mixing both unsatisfactory. A portion of this mixture was mechanically mixed in a ball mill for three hours. This improved the distribution of the hexamethylenetetramine, but the crystals were still too large. A 40-gram sample molded moderately well, but was quite grainy due to the large crystals of hexamethylenetetramine. This batch was also discarded.

Condensation No. 3: A 1-mol batch, in which the water was not distilled from the washed resinous mass.

This departure from the initial procedure did not appear to damage the resin in any way. The resin was dried under a 28-inch vacuum for two hours with the shelves heated by water circulating at a temperature of 140 deg. F. The hexamethylenetetramine was very finely ground (finer than 200 mesh) in the McCool pulverizer and was mixed with the resin in a ball mill for eight hours. The molding powder was quite satisfactory. The following standardization was made, measuring the time of molding in minutes, and the force in grams applied to the end of the lever arm of the bend testing device. Two test specimens were cut from each disk.

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 10 | 6,200 | 6,000 |
| 15 | 10,500 | 9,000 |
| 20 | 16,000 | 15,100 |
| 25 | Charred | Charred |
| 21 | 16,300 | 16,000 |
| 22 | 17,200 | 16,900 |
| 23 | 15,800 | 15,200 |

Standard curing time: 22 minutes.

Stannous chloride was finely ground in a mortar and mixed with the molding powder in such proportions that the final percentage of the salt was 5, 10 and 15 percent by weight. On molding the first test sample of the 5 percent mixture, the stannous chloride attacked the chromium plate of the mold so severely that other samples were discarded.

Condensation No. 4: A 5-mol batch of ingredients gave 380 g. of the resinous mass. This was dissolved in acetone as usual, and the resulting solution divided into five portions of equal volume. The woodflour required was a total of 250 grams or 50 grams per portion of solution. Each of these portions was treated with a solution of the proper amount (18.9 grams) of hexamethylenetetramine and the resulting pasty masses dried in the vacuum drier for one hour under a 28-inch vacuum with the shelves heated by water circulated at 194 deg. F. One portion was soaked with acetone and then impregnated with the acetone solution of the resin and dried under vacuum. This sample was used as a standard. Samples 2, 3, 4 and 5 were treated in a similar manner with hexamethylenetetramine and also with solutions containing stannous chloride in such quantities that the resulting pastes contained the salt in percentages of 5, 10, 15 and 20 percent by weight on the basis of the final molding powder. These pastes were dried under vacuum as usual, soaked with acetone, impregnated with the solution of resin, and the mixtures dried under vacuum to give the final molding powder samples. These samples were ground in the McCool pulverizer to about 100 mesh before molding was attempted. Thirty-gram samples proved satisfactory, thereby reducing the quantity of molding powder required. The breaking force was still of such proportions that it could be measured satisfactorily. The results of the molding and testing are as follows:

Sample No. 1. Standard; no $SnCl_2.2H_2O$

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 18 | 7500 | 7100 |
| 20 | Scorched | Scorched |
| 19 | 8200 | 8900 |

Standard curing time: 19 minutes.

Sample No. 2. Containing 5 percent $SnCl_2.2H_2O$

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 19 | Charred | Charred |
| 16 | Scorched | Scorched |
| 15 | 8000 | 7600 |
| 14 | 7400 | 7500 |

Proper curing time: 15 minutes.

Sample No. 3. Containing 10 percent $SnCl_2.2H_2O$

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 15 | Scorched | Scorched |
| 14 | 8300 | 9000 |
| 13 | 7600 | 7200 |

Proper curing time: 14 minutes.

ple No. 4. Containing 15 percent $SnCl_2.2H_2O$

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 14 | Scorched | Scorched |
| 13 | 8000 | 7200 |
| 12 | 6900 | 6600 |

Proper curing time: 13 minutes.

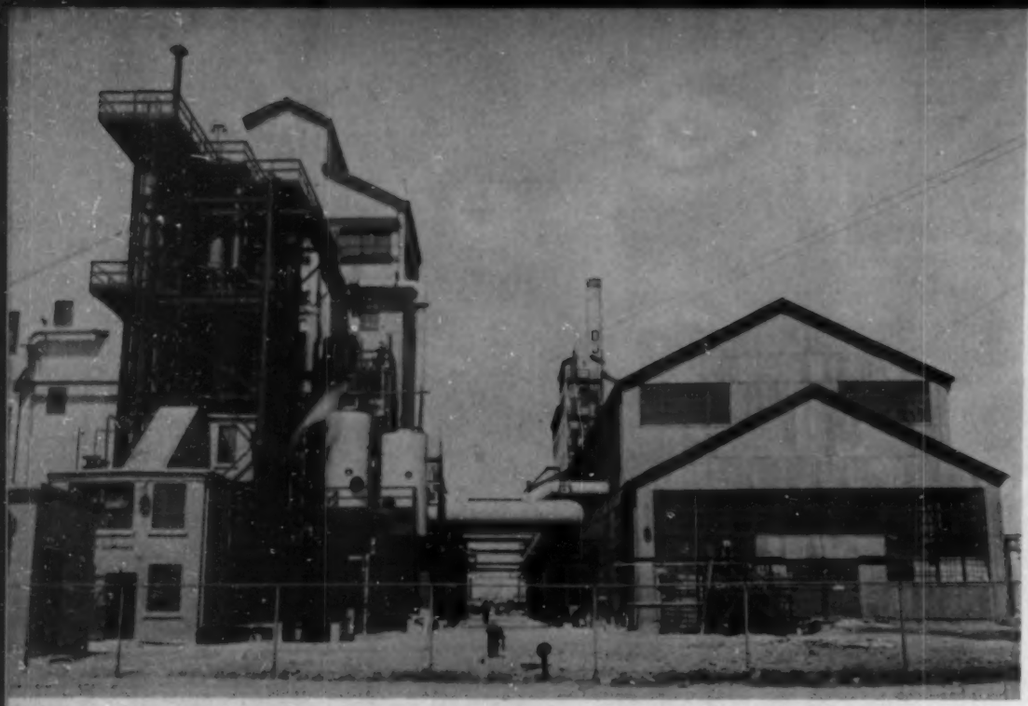
Sample No. 5. Containing 20 percent $SnCl_2.2H_2O$

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 13 | Scorched | Scorched |
| 12 | 7200 | 7500 |
| 11 | 5000 | 5400 |
| $12^1/_2$ | 7400 | 7000 |

Proper curing time: 12 minutes.

When stannous chloride is used in the manner described above, it does not attack the chromium plate of the mold to the degree previously noted, but the effects are still quite apparent. This is undesirable, and later experimentation with chromic chloride removed this difficulty of mold corrosion. As may be seen from the data above, the addition of quantities of stannous chloride decreases the strength of the resin, approximately in direct proportion to the amount of the salt which is present.

Condensation No. 5: A 5-mol batch of materials was used. The procedure for this condensation was exactly like that followed for condensation No. 4 with the exception that chromic chloride was added instead of stannous chloride. Samples of 30 grams each were used in the molding. The results of the moldings and testings are as follows: (*Please turn to page 98*)



**1**—*A general view of the front of the new synthetic phenol plant of Durez Plastics and Chemicals Co. shows one of the first and second stage production buildings*

# Manufacture of synthetic phenol

THE largest plant of its kind in the world for the production of phenol, important in the manufacture of plastics, has been opened by Durez Plastics & Chemicals, Inc., as a unit of its plastics plant at North Tonawanda, N. Y. Built under the supervision of scientists who developed the process being employed, the plant has been under construction for two years and cost more than $2,000,000. Assuring an independent and controlled source of pure phenol, the plant makes possible not only improved plastics, but has definite ordnance value as well since phenol is used in the making of certain explosives.

The advantage of the Raschig process employed in the new plant is that it produces the highest grade of phenol with a minimum of by-product. Processes heretofore employed produce from two to five pounds of by-product to one pound of phenol, while the Raschig process develops less than one-tenth of a pound of by-product for each pound of phenol.

The plant that will produce this phenol is one of the most amazing chemical units in the world. Housed in several huge buildings, the tremendous towers and distillation units are joined with forty miles of pipe, three miles of which are made of either glass, porcelain or rubber, to withstand the action of acids at high temperatures. Since the stoppage of action at any one point might disrupt the process duplicate equipment has been installed at every stage for use in case of trouble.

The process itself is so intricate that many leading chemical engineers in this country refused to consider it when it was first offered here a few years ago. Briefly it consists, first, in passing a vapor mixture of benzene hydrochloric acid and air through a catalyst. This produces a mixture of chlorinated benzenes from which monochlorbenzene is distilled in the pure state for use in the second step. Second, a vapor mixture of monochlorbenzene and steam is passed through a catalyst which produces phenol and regenerates the hydrochloric acid. These two stages actually form a

**2**—*Harry M. Dent, president of the firm*

completely continuous process, and during the process most of the materials formed and the catalysts are recovered for re-use. The process can be likened to a game of ring-around-a-rosie; the process making a continuous circle with the phenol being extracted or drawn off as it is formed, and new materials and new catalysts added as the original ones seem to wear out or become used up.

The first stage reaction proceeds at about 230 deg. C., is exothermic, and is represented by the equation:

$$C_6H_6 + HCl + {}^1/_2O_2 = C_6H_5Cl + H_2O$$

About ten percent of the benzene is converted in one pass through the catalyst. Small quantities of polychlorbenzenes are formed, and some slight oxidation takes place. The actual products of the first stage reaction are: $C_6H_6$, $C_6H_5Cl$, polychlorbenzenes, $CO_2$, CO, $N_2$ and $H_2O$, so that several orderly steps are required to effect the separation and recovery of the products of the reaction. This is accomplished by continuous fractional condensation whereby the chlorinated benzenes and part of the unreacted benzene are collected in liquid form for the separate recovery, by continuous fractional distillation, of benzene, monochlorbenzene and a mixture of the polychlorbenzenes. A part of the balance of unreacted benzene vapor is condensed for re-use, in a final condenser, while the remainder is recovered by scrubbing the tail gases with an organic absorbing liquid from which benzene is continuously distilled and condensed for re-use.

In practice the first stage system operates by drawing the first stage reactants in the vapor state, at slight

3

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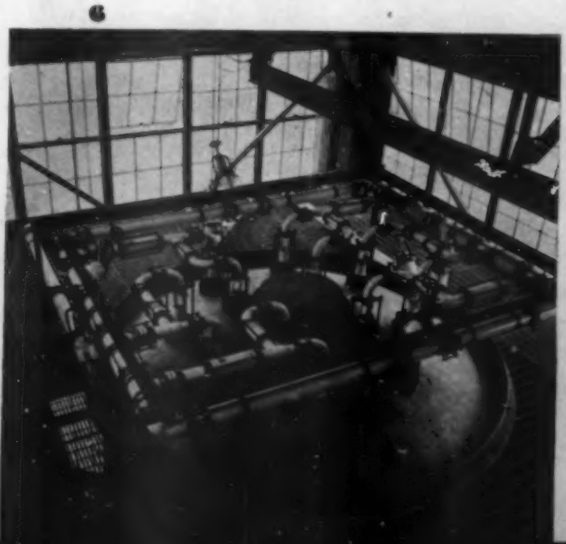
***3—In the center is the vapor mixer into which is drawn raw material used in the first stage. Recovered acid evaporators are located at either side. 4—A section of the distillation building shows the chlorobenzene stills with delicate pumps that assure continuous operation. 5—Operator watches control panel governing the first stage of the process. 6—Top of desuperheating tower is where recovered acid is concentrated during second stage. It is then sent to acid extractors for phenol removal, then on to the evaporators for reuse. 7—Actual phenol is formed here at about 420 deg. C. All piping has $^1/_8$ in. layer of glass wool insulation. 8—Automatic gas valve time control board coordinates action of second stage gas valves***

6



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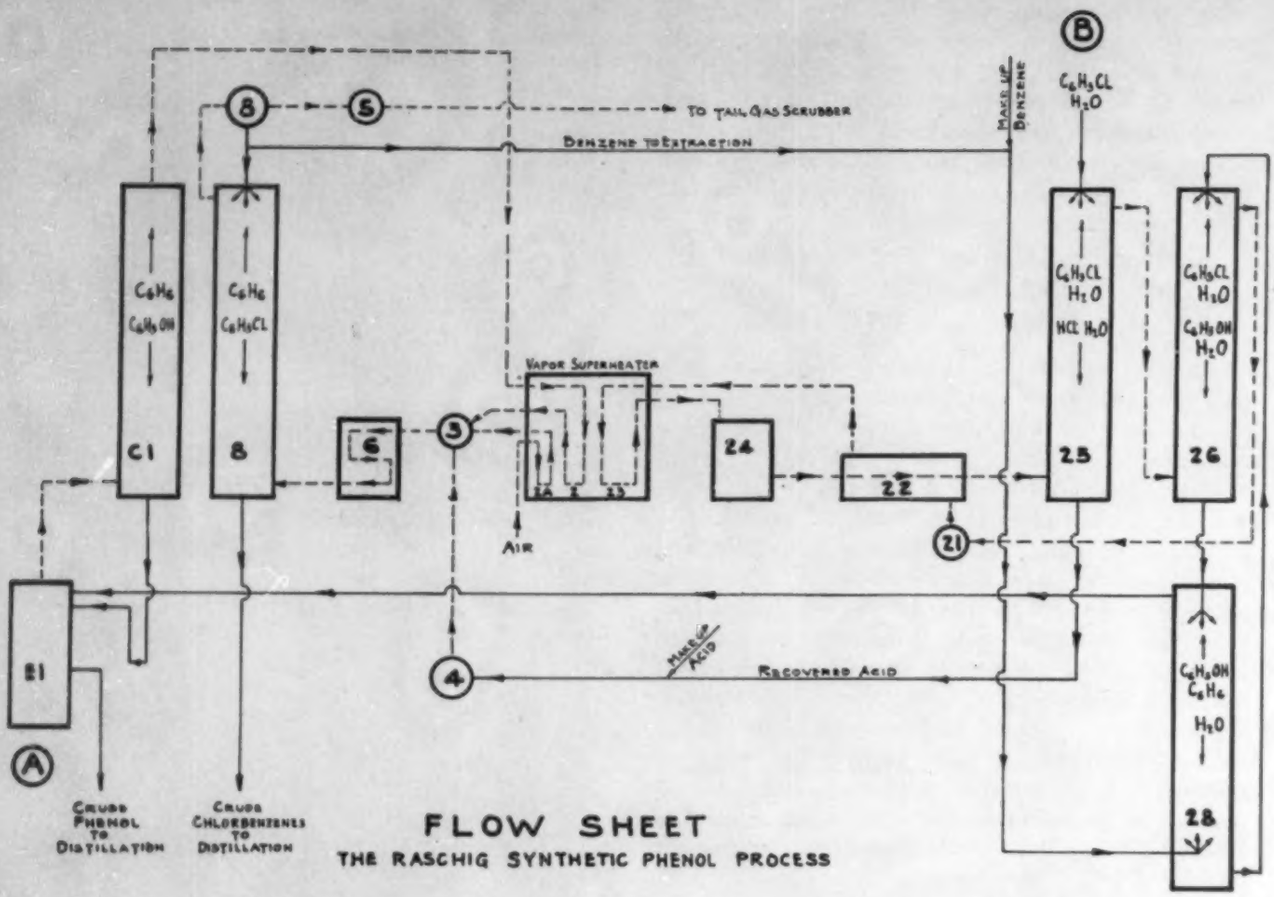



**FLOW SHEET**
THE RASCHIG SYNTHETIC PHENOL PROCESS

negative pressure, in succession, through contact chambers, a fractional condensing tower, and a final condenser. When and as conversion to form first stage products takes place, these products condense and are removed from the fractional condenser, which operates at a temperature slightly above the boiling point of benzene. The benzene vapors which pass from the fractional condenser are then condensed and recovered from the final condenser and tail gas recovery system.

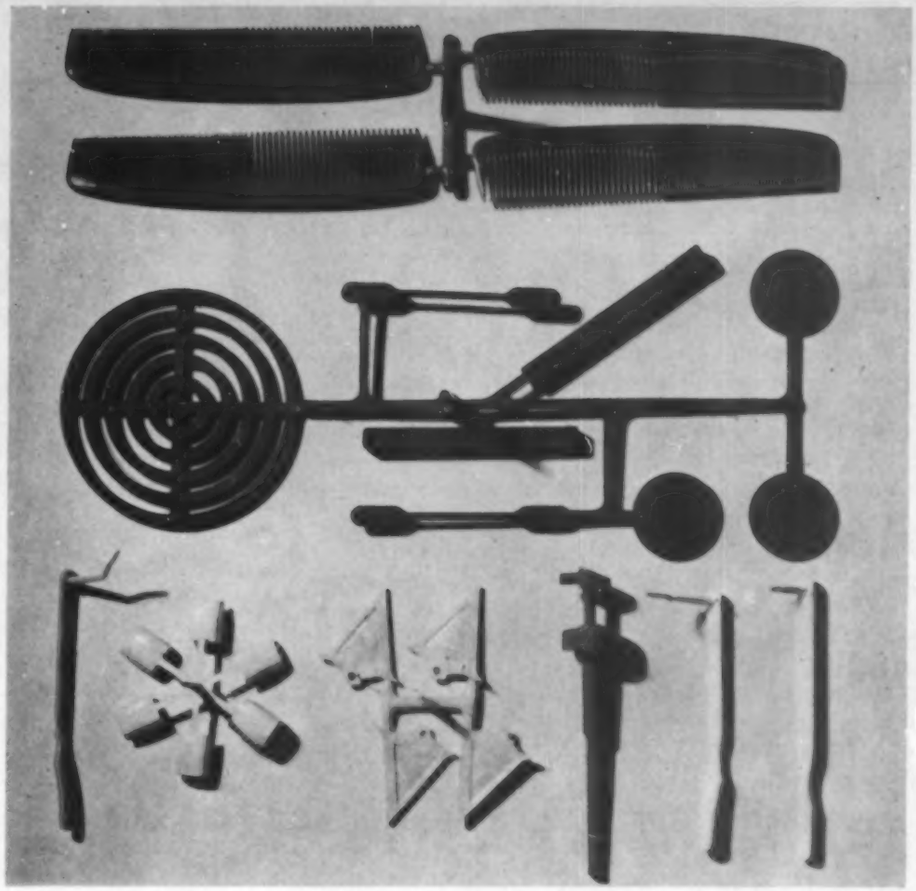
The second stage reaction proceeds at about 425 deg. C., is endothermic, and is represented by the following equation:

$$C_6H_5Cl + H_2O = C_6H_5OH + HCl$$

Again about ten percent of the monochlorbenzol is converted in one pass through the catalyst. Since more water is present than given by the equation and since traces of side reaction products are formed, the actual products of the second stage reaction are $C_6H_5OH$, HCl, $H_2O$, oxydiphenyl and diphenyl ether, so that several orderly steps are required to effect the separation and recovery of these products. By heat interchange between the products of the reaction and the azeotropic vapor mixture of the reactants, the products are first cooled to about 200 deg. C. and then further cooled in a fractional condenser by being required to vaporize a liquid mixture of the reactants. Next, a fraction consisting of a water solution of HCl (15 percent) containing about 5 percent of the phenol is condensed and recovered. Leaving the fractional condenser the vapors contain about 95 percent of the phenol formed, together with all the azeotropic mixture of the reactants. The phenol is dissolved from the vapors by scrubbing with hot water under temperature conditions such that the azeotropic vapor mixture of the reactants remains in the vapor state to be later heated to reaction temperature and passed through the second stage contact chambers.

The products of the second stage reaction are thus collected in the form of a recovered HCl solution (15 percent) containing dissolved phenol and a water solution of phenol. These phenol solutions are separately extracted in continuous counter-current fashion by benzene, which extraction step constitutes the entry point for the benzene required in the first stage reaction. After benzene extraction to remove phenol the recovered HCl solution passes to HCl vaporizers to supply that reactant of the first stage reaction. The extracted water solution of phenol is reheated to strip it of benzene, which is condensed and returned to the phenol scrubber to absorb more phenol.

The combined benzene-phenol solutions from the extraction steps pass to a continuous fractionating still. The distillate from this column delivers benzene vapor to constitute that reactant of the first stage reaction while the out-flow from this column consists of crude phenol (97 percent) which is subsequently recovered in pure state by continuous *(Please turn to page 100)*



*At right are various forms of injection molded castings made of Vinylite. In the center is a test specimen which is regularly run on batches of this injection molding materials to assure uniformity of weld strength impact resistance, water-resistance, etc. This center casting weighs 7 1/2 ounces*

# Thermal efficiency in injection molding

by L. K. MERRILL*

DEVELOPMENTS in the art of injection molding appear with a rapidity that is an interesting reflection of the collaborative activity of machine manufacturers, material suppliers, and particularly, plastic-parts producers. The ingenuity of the latter group—in bettering the efficiency of high-quantity production, improving mold and part design, developing decorative schemes, and offering many useful advantages in the finished part—produces benefits characteristic of those that accrue from typically American competitive technological progress. In the course of this fast-moving trend, it is natural that some possibilities for increased efficiency might be overlooked, and, since they may ultimately become of definite importance to the molder, it is well to consider their potentialities.

* Vinylite Div., National Carbon Co., Inc.

One of the important savings that can be made in injection molding is in the amount of heat energy required to plastify the charge. The energy required to plastify any thermoplastic material can be calculated theoretically; it is a function of the mass of the material, the temperature rise, and the specific heat of the compound. These factors can be reduced to the equation: Weight of Material (g.) × Temperature Rise (deg. C.) × Specific Heat (cal. per g. per deg. C.) = Energy Required (small cal.).

If 1-oz. charges of each of four commercial injection-molding materials are heated from room temperature to their respective commercial plastifying temperatures, the energy requirements are as shown in Table 1.

Since the capacity of injection-molding heating cylinders involves a volumetric relation, while the

Table 1. Energy Requirements for One Ounce Charges of Various Injection-Molding Materials

| Material | Assumed temperature rise, Deg. C. | Specific heat | Plastifying energy required per oz., small cal. |
|---|---|---|---|
| Vinyl copolymer resin | 142 (65°F. to 320°F.) | 0.24 | 967 |
| Polystyrene | 186 (65°F. to 400°F.) | 0.32 | 1,690 |
| Cellulose acetate | 175 (65°F. to 380°F.) | 0.35 | 1,740 |
| Acrylate resin | 186 (65°F. to 400°F.) | 0.40 | 2,110 |

density of all of the materials is not the same, the above tabulation must be restated as in Table 2. These figures are based on the theoretical capacity unit fixed by a cylinder operating on a 1-oz. charge of cellulose acetate, modified by the assumption that the cylinder is always full volumetrically. Thus 0.81 oz. of polystyrene, for instance, occupies the same volume that would be filled by the 1-oz. charge of cellulose acetate.

Table 2. Energy Requirements for Unit Volume Charges of Various Injection-Molding Materials

| Material | Specific gravity | Specific volume, cu. in. per lb. | Cylinder charge based on volume of 1 oz. of acetate, oz. | Plastifying energy required per charge, small cal. |
|---|---|---|---|---|
| Vinyl copolymer resin | 1.35 | 20.5 | 1.04 | 1,010 |
| Polystyrene | 1.05 | 26.4 | 0.81 | 1,370 |
| Cellulose acetate | 1.30 | 21.3 | 1.00 | 1,740 |
| Acrylate resin | 1.15 | 24.1 | 0.89 | 1,890 |

While this is a purely theoretical computation, it serves to show that there should be a fundamental difference in the heat-input requirement for any given cylinder when operating on these different materials. From a practical standpoint, however, this is obviously not the whole story. The total thermal input to an injection-molding cylinder is based on the energy required to satisfy the following conditions.

(1) To plastify a mass of material equivalent to the cylinder capacity at a rate commensurate with the cycle on which the machine is operating;
(2) To supply all radiation and conduction losses;
(3) To assure reasonably short warming-up intervals when the machine is started up from the cold;
(4) To be suitably balanced to minimize dangerous temperature surges on the active heating surfaces in contact with the plastic material.

### Power dependent on molding cycle

From the earlier discussion it is apparent that the first of these factors involves an inherent and fundamental variable which is specific with the material. Those materials which require less heat energy to be plastified will, in the end, require less total heat than the others. It is important, however, to consider the rate at which this heat is supplied. The required power is a function of the range of molding cycles involved.

For instance, a cylinder operating on 1 oz. of vinyl copolymer resin will theoretically require a total of 967 small cal. per charge. If the machine is functioning on a 15-sec. cycle, this energy must be delivered at a rate of $\frac{967}{15} = 64.5$ small cal. per sec. Since 1 small cal. per sec. is equal to 4.18 watts, the true power consumption is $64.5 \times 4.18$ or 270 watts. In a similar manner, the same resin charge on a 30-sec. cycle needs only 135 watts. That this condition is really important is apparent from Table 3 wherein theoretical power requirements for one material operating at different cylinder capacities and molding cycles are presented.

Table 3. Theoretical Power Requirement to Plastify Vinyl Copolymer Resin for Varying Cylinder Capacities and Cycles

| Time of Cycle | Power Requirement for Cylinder Capacity of: | | | | | |
|---|---|---|---|---|---|---|
| | 1 oz. | 2 oz. | 4 oz. | 6 oz. | 8 oz. | 12 oz. |
| sec. | watts | watts | watts | watts | watts | watts |
| 15 | 270 | 540 | 1,080 | .... | .... | .... |
| 20 | 200 | 400 | 800 | 1,200 | .... | .... |
| 30 | 135 | 270 | 540 | 810 | 1,080 | 1,620 |
| 45 | ... | ... | 360 | 540 | 720 | 1,080 |
| 60 | ... | ... | .... | 400 | 540 | 800 |

When the differences in the fundamental heat-energy requirement of various materials (Table 1) are considered in addition to this wide range of operating cycles and the number of cylinder capacities, it is evident that the heating mechanism and the control of the rate of heat input must be designed to cover a multitude of variations. This has its obvious complications. It is significant, however, that doubling the cylinder capacity does not necessarily mean doubling the heating capacity, because, in most cases, the rate of molding is reduced to some extent.

### Heat losses

The second point, thermal radiation and conduction losses, is, in most machines operating today, a definite contributor to high operating costs, regardless of the type of heating used, whether electrical or otherwise. In an attempt to obtain some indication of the facts pertaining to this condition, a continuous test run was recently made on the same molding machine using two different types of molding compounds. A recording wattmeter was placed in the input of the heating circuit. The results of this experiment are shown in Table 4.

From this table, it is apparent that a true energy consumption in excess of 3 times the theoretical requirement may commonly be expected. This affords a

wide opportunity for design efforts to improve thermal efficiency. Moreover, radiation and conduction losses are going to increase as the operating temperatures are raised, and, therefore, materials which require processing at higher temperatures will always have a proportionally higher increment in the amount of energy lost.

In cylinders heated by induction, the so-called *magnetic* type, the warming-up interval from the cold state is more or less automatically compensated. In all other types, however, the increased thermal requirement to bring a cylinder up to temperature is best achieved by an auxiliary heating element that can be manually operated during warm-up, then disconnected from the controlled circuits which supply the thermal requirements under normal operating conditions. In many cases, the same result can be accomplished by interconnecting series and parallel windings in the same heating element. The important thing is that all circuits be adjusted for higher wattage inputs when starting up than are necessary when stable operating conditions have been reached.

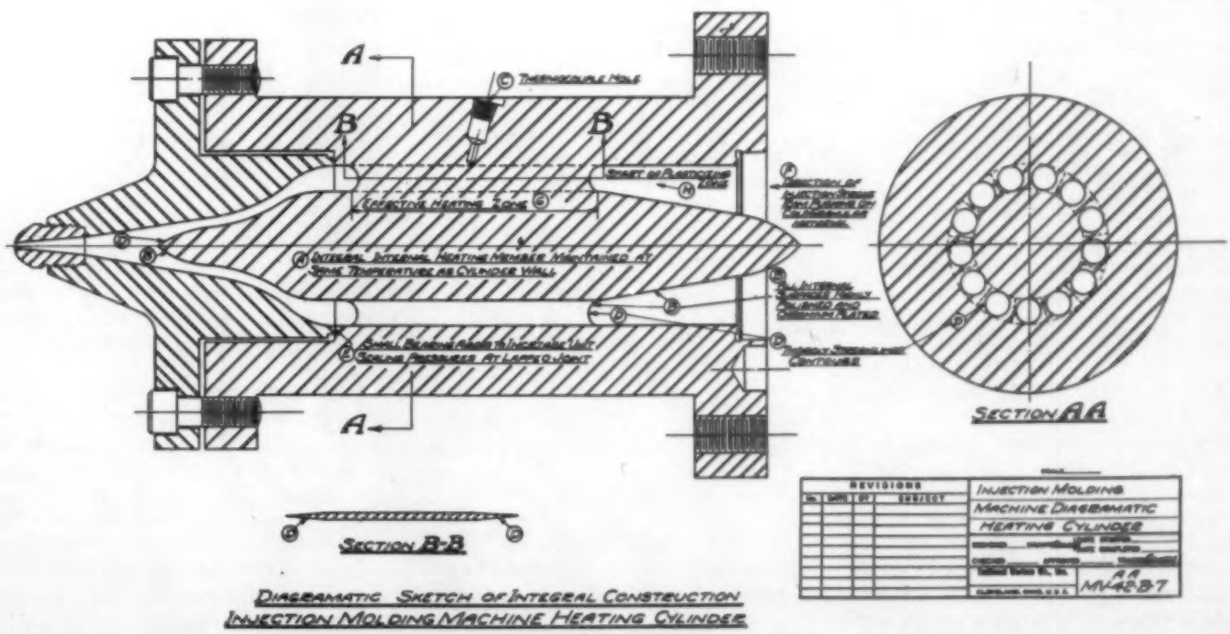
Once an operating cylinder is in thermal balance, the most efficient condition is achieved by a constant heat input taking care of all normal requirements of the cylinder and an auxiliary element or elements functioning from a temperature-controlling device that puts them in or out of operation in accordance with the thermal demands of the cylinder. In addition to being more efficient, such a system prevents such dangerous temperature surges in the cylinder wall that might be caused by the intermittent operation of high-capacity heating elements. On materials which are thermally sensitive in their operating behavior—and all materials are more so than is sometimes recognized—the prevention of violent temperature surges in the cylinder wall has an important bearing on quality of the moldings.

Table 4. Energy Consumption in Injection Molding

| | Material A | Material B |
|---|---|---|
| Minutes during test run | 58 | 31 |
| Amount of material molded, lb. | 27.53 | 10.87 |
| Molding cycle, sec. | 55 | 66 |
| Size of each casting, oz. | 7.2 | 7.2 |
| Compound effluent temperature, deg. C. | 147 | 200 |
| Capacity of heating cylinder, watts | 3,600 | 3,600 |
| Recorded total energy consumption, kw-hr. | 1.642 | 1.550 |
| Theoretical total energy requirement, kw-hr. | 0.495 | 0.401 |
| Actual energy consumption per pound of castings molded, watt-hr. | 59.7 | 142.6 |
| Theoretical energy requirement, per lb. of castings mol[illegible]d, watt-hr. | 18 | 37 |
| Ratio of Actual energy consumption / Theoretical energy consumption | 3.32 | 3.88 |
| Thermal efficiency, percent | 30.2 | 26.0 |

The matter of accurate temperature measurements on heating cylinders is receiving more and more attention, and this is paying dividends in terms of both improved quality of the castings and versatility of the operating units. After all, it is a questionable practice to jeopardize the operation of an expensive molding machine by attaching inaccurate temperature-control and measuring devices when such instruments are, in one sense, the basis of successful machine operation.

All these considerations can be reduced to one general endeavor—balancing the characteristics of the heating cylinder to the job it is expected to perform. When this is done properly, operating economies will be greater and the quality of the parts produced will be even better than the high standards already achieved.




Diagramatic Sketch of Integral Consteuction Injection Molding Machine Heating Cylinder

# Plastics Digest

**This digest includes each month the more important articles (wherever published) which are of interest to those who make plastics materials or use them. Requests for copies of the magazines mentioned should be directed to the individual publishers whose addresses will be mailed upon receipt of a self-addressed stamped envelope.**

## General

COMPLETE SHOCKPROOFING. G. E. Moore. Elec. Review (London) *127*, 107–8 (Aug. 9, 1940). The latest edition of the I. E. E. Regulations for the Electrical Equipment of Buildings contains the following clause "It is strongly recommended that electrical apparatus of the all-insulated type be installed wherever practicable, and that the use of electrical apparatus (particularly electric toasters and hairdryers) having exposed metal parts be avoided as far as possible. The installation is also recommended of lampholders so constructed of, or so shrouded in, insulating material that it is impossible to touch any metal part of a lamp-cap or lampholder plug inserted therein." The availability of plastics for the construction of all-insulated equipment, particularly molded housings, is said to have been in large measure responsible for this revolutionary recommendation.

PLASTIC BODYWORK. F. C. Sheffield. Automobile Engineer *30*, 229–34 (Aug. 1940). This article summarizes the technic developed in Germany and patented by the Auto Union for the construction of bodies from reinforced plastics for automobiles. Pre-formed panels and structures are built up from paper or fabric impregnated with synthetic resin and consolidated under heat and pressure to the desired shape and section. Cars made of this material in a variety of designs have been used in ordinary service over considerable periods and have been tested ruthlessly to destruction. In such tests as head-on collisions, driving into solid masonry obstructions, overturning and rolling down steep inclines both forward and sideways, they were found to stand up as well as and in some respects better than similar cars built on orthodox lines and fitted with metal bodies. These are the molded cars referred to by Hitler in his remarks at the opening of the Berlin Motor Show in 1938.

VULCANIZED FIBER. Product Eng. *11*, 292–6 (July 1940). In 1846 two French chemists discovered that filter paper, dipped in 66 deg. Be. sulfuric acid, washed free of acid, and dried, became a hard, dense substance. In 1859 Taylor found that a 70 deg. Be. zinc chloride solution produced this same effect. Paper treated with these reagents and laminated under light pressure sticks firmly together, and when leached free of the chemical and dried, becomes a hard, almost homogeneous sheet. Production of sheets, rods, tubes, and various shaped articles, and their utilization in electrical insulation, washers and gaskets, textile machinery parts, and other applications are described.

## Materials and Manufacture

POLYSTYRENE. A. J. Weith, V. H. Turkington, and Ivey Allen, Jr. Ind. and Eng. Chem. *32*, 1301–4 (Oct. 1940). Some recent developments in the chemistry of styrene polymerization are reviewed briefly. Consideration is given to the flow characteristics, thermal stability, and other physical and chemical properties of the polymer is relation to its use in injection molding. Recent work on the control of the polymerization has made practical the production of styrene resins which are readily soluble in drying oils and have possible applications in coatings. Production of styrene as a by-product from various cracking processes and by synthesis is reviewed.

LACTIC ACID AS A COMPONENT OF SYNTHETIC RESINS. J. T. Stearn, B. Makower, and P. H. Groggins. Ind. and Eng. Chem. *32*, 1335–42 (Oct. 1940). See MODERN PLASTICS *17*, 53 (May 1940) for abstract of this paper.

COTTONSEED PLASTIC. Business Week *1940*, 51 (Oct. 19). Cottonseed hull compounded with furfural and phenol makes a hard, black plastic of light weight. This is a development of the University of Tennessee Research Corp. and the molding composition is being formed into various products by a firm in Knoxville. The experiment station is now working on processes for the production of furfural from the hull, utilization of the lignin residue in a plastic composition, and extraction of a protein from cottonseed for use in protective coatings and synthetic textile fibers.

EMULSION POLYMERIZATION. H. Barron. Brit. Plastics *12*, 121–6, 137 (Sept. 1940). A review of the production of synthetic rubbers by emulsion methods.

## Applications

PLASTICS FOR MECHANICAL HANDLING. J. S. Trevor. Mech. Handling *27*, 155–7 (July 1940). Conveyor boxes, friction rollers, pulleys, bearings, escalator rollers, and coal belts are among the parts now made of plastics for rapid handling of materials. An American insurance company uses conveyor boxes made of laminated plastic of three-sixteenths inch wall thickness for handling correspondence in a vertical, endless-chain system.

PLASTICS IN THE FOOD INDUSTRY. H. K. Wood. Plastics *4*, 186–7 (Aug.); 199–200 (Sept. 1940). Opportunities for the use of plastics in food processing plants and in packaging foods are considered.

PLYWOOD REFRIGERATOR CARS. Railway Age *109*, 275–8 (Aug. 24, 1940). The St. Louis Refrigerator Car Co. has recently placed in service 25 40-ton cars in which resin-bonded plywood was used for floors, lining, roofs, siding, insulation, and, in fact, throughout the entire body of the car except the steel ends. A saving of 6000 pounds in weight was effected and a considerable economy in fabrication costs was obtained by reducing the number of joints 86.5 percent and the number of screws and nails 19 percent.

PLASTIC-ON-METAL FINISHES. Iron Age *146*, 48–50 (Aug. 15, 1940). Vinyl resins can be used for formulating protective coatings for steel products which will withstand severe fabricating operations and contact with a variety of corrosive chemicals.

## Testing and Properties

INFRARED TRANSMISSION OF THIN FILMS OF VARIOUS ORGANIC MATERIALS. A. J. Wells. J. Applied Physics *11*, 137–40 (Feb. 1940). The transmissions of thin films of regenerated cellulose, ethylcellulose, cellulose acetate, cellulose nitrate, polystyrene, glyceryl-phthalate resin, rubber hydrochloride, rubber, methyl methacrylate polymer, and vinyl resins were measured between 400 cm.$^{-1}$ and 3000 cm.$^{-1}$ The possibility of using certain of these materials for windows in spectrometers is discussed.

SOME RELATIONS BETWEEN MOLECULAR STRUCTURE AND PLASTICIZING EFFECT. A. Kirkpatrick. J. Applied Physics *11*, 255–61 (Apr. 1940). The interrelation between the chemical constitution and structure of plasticizers and plastics is discussed. The effects of sulfonamide, phthalate, and phosphate plasticizers in cellulose acetate compositions with respect to retentivity, permeability to moisture, and flow are compared. The author speculates on the possibility of formulating general rules covering the presence in both plasticizer and plastic of groups that afford points of mutual attraction, proper location of each of these groups, and proper shape of the molecules.

# Tenite for a GOOD RECEPTION

THIS portable radio, encased in Tenite, is a perfect companion for the outdoor enthusiast. It is small in size and light in weight—easy to carry by the shoulder-strap aerial.

The Tenite case absorbs shocks and vibrations—acts as a strong protection for the radio. Exposure and constant handling will not mar its lustrous beauty.

Only one injection molding cycle is necessary to produce the complete case. High speed production and rapid assembly by metal fasteners, crimped and riveted to the Tenite, cut manufacturing costs—help place the radio within reach of modest purses.

Tenite has been chosen in preference to other materials for many types of instrument housings, such as thermostats, oil gauges, meters, sales registers and bathroom scales. A 28-page book describing and illustrating the uses of Tenite will be sent on request.

**RADIO HOUSING**
***Molded by Thermo-Plastics, Inc. for Philco Radio & Television Corp.***

**TENITE REPRESENTATIVES:** *New York*, 10 East 40th St. *Buffalo*, 1508 Rand Building. *Chicago*, 2264 Builders' Building. *Detroit*, 904-5 Stephenson Building. *Leominster, Mass.*, 39 Main St. . . . Pacific Coast: Wilson & George Meyer & Company—*San Francisco*, Federal Reserve Building; *Los Angeles*, 2461 Hunter St.; *Seattle*, 1020 4th Ave., South.

**TENNESSEE EASTMAN CORPORATION**
**Kingsport, Tenn.** ***Subsidiary of the Eastman Kodak Co.***

# U. S. Plastics Patents

**Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each.**

ETHYLENE INTERPOLYMERS. M. W. Perrin, E. W. Fawcett, J. G. Paton and E. G. Williams (to Imperial Chemical Industries, Ltd.). U. S. 2,200,429, May 14. Interpolymerizing ethylene with one or more other olefins or olefin derivatives under high pressure.

POLYMER FILMS. H. D. Foster (to E. I. du Pont de Nemours and Co.). U. S. 2,212,770, Aug. 27. Flash cooling as a feature of forming films from a linear polymer melt by extrusion through a slot onto a support.

LINEAR POLYMERS. G. D. Graves (to E. I. du Pont de Nemours and Co.). U. S. 2,212,772, Aug. 27. Forming shaped articles from fiber-forming synthetic linear polymers by shaping and flash cooling.

PLASTIC FIBROUS PRODUCT. E. C. Sherrard, E. Beglinger, J. P. Hohf and E. Bateman (to the Secretary of Agriculture of the U. S. A.). U. S. 2,212,866, Aug. 27. Chlorinating vegetable fibers in vacuum, heating the product in air and adding a plasticizer to form a material showing plastic flow under heat and pressure.

ALDEHYDE POLYMERS. C. C. Allen (to Shell Development Corp.). U. S. 2,212,894, Aug. 27. Making fusible, soluble resins by polymerizing alpha- or beta-substituted acroleins.

RESISTOR. G. M. Ehlers (to Globe-Union, Inc.). U. S. 2,213,067, Aug. 27. Molded insulating caps for fixed resistors are formed in place by assembling a resin-impregnated disk on a headed lead wire and molding the disk under heat and pressure.

CREPE-LIKE FABRIC. E. Hubert and H. Rein (to I. G. Farb. Akt.). U. S. 2,213,125, Aug. 27. Making imitation crepe by interweaving synthetic resin filaments with textile threads and heating above the softening point of the resin.

TEXTILE MARKING INK. W. L. Jones (to Interchemical Corp.). U. S. 2,213,126, Aug. 27. A pigmented blend of nitrocellulose and ethylcellulose in an organic solvent, for use as a marking ink not removed by carbon tetrachloride.

STYRENE INTERPOLYMER. E. C. Britton and G. H. Coleman (to Dow Chemical Co.). U. S. 2,213,201, Sept. 3 Plasticizing a styrene interpolymer by adding a bis(chlorophenyl)alkane.

CHLOROISOBUTYLENE RESIN. M. H. Arveson (to Standard Oil Co. of Indiana). U. S. 2,213,331, Sept. 3. Chlorinating a plastic polyisobutylene to a chlorine content of more than 5 and less than 75%.

ABRASIVE SHAPES. A. L. Ball (to Carborundum Co.) U. S. 2,213,332, Sept. 3. Wetting abrasive grains with waterglass, mixing with a heat-hardenable resin powder, shaping and heating the article.

OLEFIN INTERPOLYMER. P. J. Gaylor (to Standard Oil Development Co.). U. S. 2,213,423, Sept. 3. Compounding rubber with an interpolymer of a vinyl compound and an olefin higher than ethylene.

MOLDING COMPOSITION. D. E. Cordier (to Plaskon Co.). U. S. 2,213,577-8, Sept. 3. Making moldings from urea resins plasticized with formaldehyde condensation products of alkylenediamines.

ACETALS. D. R. Swan (to Eastman Kodak Co.). U. S. 2,213,750-1-2, Sept. 3, Polyvinyl acetal resins derived from alpha-halogenated aldehydes; benzyl maleate as elasticizer in rubbery sheets of acetal resin; and di-tetrahydrofurfuryl phthalate as elasticizer in similar sheets.

ACETALS. J. J. Gordon; H. B. Smith (to Eastman Kodak Co.). U. S. 2,213,763; 2,213,771, Sept. 3. Plasticizing polyvinyl acetals with N, N-dibutyl acetamide, N-butyl diacetamide, N-butyl dipropionamide or acetoacetamide; and plasticizing such resins with trimethyleneglycol ditetrahydrofuroate.

INSULATOR. R. Stewart (to Continental-Diamond Fibre Co.). U. S. 2,213,922, Sept. 3. Forming an insulator from laminated material impregnated with a synthetic resin.

CELLULOSE ETHERS. H. M. Spurlin (to Hercules Powder Co.). U. S. 2,214,070, Sept. 10. Purifying high-substituted ethylcellulose by dissolving in a hot solvent which is not a solvent in the cold, and cooling sufficiently to precipitate components which would cause graininess.

LACQUER. G. R. Ensminger (to E. I. du Pont de Nemours and Co.). U. S. 2,214,127, Sept. 10. A greaseproof nitrocellulose lacquer contains an alkyd resin modified with a nondrying oil.

PROTEIN PLASTIC. C. H. Luby (to Corn Products Refining Co.). U. S. 2,214,140, Sept. 10. Making molded articles from a vegetable protein which is hardened only at the surface.

SAFETY GLASS. F. L. Bishop and C. S. Shoemaker (to American Window Glass Co.). U. S. 2,214,158, Sept. 10. Drying a plastic interlayer on a glass sheet, applying a contacting agent and assembling the sandwich under pressure.

PLASTICIZED POLYAMIDES. P. R. Austin (to E. I. du Pont de Nemours and Co.). U. S. 2,214,397, Sept. 10. Plasticizing linear fiber-forming polyamide resins with a cyclic ketone.

POLYAMIDE PLASTIC. W. H. Carothers (to E. I. du Pont de Nemours and Co.). U. S. 2,214,402, Sept. 10. Compounding a fiber-forming polyamide resin with a phenol.

PLASTICIZED POLYMIDES. D. D. Coffman (to E. I. du Pont de Nemours and Co.). U. S. 2,214,405, Sept. 10. Plasticizing a linear polyamide resin with a high-boiling monomeric amide.

STABILIZED POLYAMIDE. E. W. Spanagel (to E. I. du Pont de Nemours and Co.). U. S. 2,214,442, Sept. 10. Heat-stabilizing synthetic fiber-forming polyamides by adding a high-boiling agent to depress the melting point, for making shaped articles from a melt of the plastic.

TOP AWARD

UARCO Sales Register molded by Sinko Tool & Mfg. Company

TOP AWARD

Chrysler Dashboard Panel molded by Chrysler Corporation

TOP AWARD

Philco Portable Radio molded by The Standard Products Co.

TOP AWARD

Mueller Showerhead molded by The Standard Products Company

HONORABLE MENTION

Whiting Name Plate molded by Gits Molding Corporation

HONORABLE MENTION

Riddell Football Helmet molded by Sinko Tool & Mfg. Co.

HONORABLE MENTION

Aeronca Airplane Panel molded by The Standard Products Co.

# More *Awards* were won with H-P-M INJECTION MOLDING PRESSES than with any other make

**Results of Modern Plastics Competition—**

**TOP AWARDS**

| | |
|---|---|
| Injection Molded | 11 |
| (H-P-M Presses made 4 of these) | |
| Compression Molded | 11 |
| Misc. (Fabricated) | 20 |

**HONORABLE MENTIONS**

| | |
|---|---|
| Injection Molded | 10 |
| (H-P-M Presses made 3 of these) | |
| Compression Molded | 8 |
| Misc. (Fabricated) | 10 |

**MOLD YOUR PLASTIC PARTS WITH H-P-M INJECTION MOLDING PRESSES**

**First Built in America—Still FIRST in 1940**

●

**THE HYDRAULIC PRESS MFG. CO.**

**Mount Gilead, Ohio, U. S. A.**

District Sales Offices: New York, Syracuse, Detroit and Chicago

Representatives: Boston, Worcester, Hartford, Providence, Pittsburgh, Akron, Cleveland, Cincinnati, Flint, Seattle, San Francisco, Los Angeles

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# Publications

**Write direct to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices**

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### Textile Testing

**by John H. Skinkle**
**Chemical Publishing Co., Inc., 148 Lafayette St., New York, 1940**
**Price $3.00** **272 pages**

This authoritative discussion of methods of testing textiles may well be of interest to those who use fibers and fabrics as reinforcing agents in plastics. An introductory chapter of four pages which summarizes the application of statistical analysis to test results is a gem which should be of value to anyone engaged in physical testing who is not already thoroughly conversant with statistical methods. G. M. K.

● FACTS CONCERNING POLYVINYL ACETATES ARE contained in a technical bulletin just issued by The R. & H. Chemicals Department of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Information concerning different grades and specific applications is given. The bulletin also contains a discussion of the uses of polyvinyl acetates in various industries.

● A BULLETIN DESCRIBING ITS LINE OF "SENIOR" presses has been issued by Colonial Broach Co., 147 Jos. Campau, Detroit. The presses range from 1 to 10-ton capacity and from 18 to 42-inch stroke, it is claimed, and are completely hydraulic in operation, designed for general purpose use, including assembly, straightening and broaching work.

● A 12-PAGE BULLETIN DESCRIBING DECORATIVE material has been issued by the Formica Insulation Co., Cincinnati, Ohio. The booklet is well illustrated and contains a section devoted to available colors, inlays and realwood designs.

● "INDUSTRY'S CHALLENGE TO RESEARCH" IS THE title of a report issued by The Research Advisory Service and based on 1042 answers received in response to the question, "What new product, process or material might industrial research develop that would be valuable to your industry?" Certain items that have been indicated by the National Inventors Council, at the request of the Advisory Committee to the Council of National Defense, as those most urgent from the standpoint of national defense are marked. Thirty-four items are listed under the heading, plastics.

● A NEW 24-PAGE FACTUAL MANUAL ON MODERN home wiring practices assuring electrical adequacy, called the "G-E Home Wiring Handbook," has been published by General Electric appliance and merchandise department, Bridgeport, Conn. It contains a detailed description of home wiring methods, a guide for checking and writing specifications, and material specifications for home wiring, as well as several suggested ways of proving the adequacy of the installation afterwards, and a series of convenient tables.

● PANGBORN CORP., HAGERSTOWN, MD., IS ISSUING a series of six new bulletins on airless, Rotoblast barrels, tables and special machines, used for blast cleaning and dust collecting.

● "IT'S A NEW BUSINESS CUSTOM" TELLS THE STORY of problems encountered by well-known corporations and how they were licked by the use of plastics. Released by Durez Plastics and Chemicals, Inc., the booklet contains 20 pages with many illustrations. It should prove of interest to all those concerned with the practical applications of plastics.

● SELLSTROM MFG. CO., 615 N. ABERDEEN ST., CHICAGO has issued a new 72-page catalog on the various types of eye protectors and modern protective equipment extending from welding lens and welders' helmets to Oxford glasses with tinted lenses.

● CARLYLE JOHNSON MACHINE CO., MANCHESTER, Conn. has issued a 10-page catalog containing revised data on the Johnson standard type and Super-Johnson type expanding ring friction clutch. A separate bulletin covers the new Maxitorq multiple-disk type clutch available in single and double, wet plate as well as dry plate, and which can be manually assembled or disassembled.

● MANUFACTURERS SCREW PRODUCTS, CHICAGO, Ill., has issued a data sheet which includes a complete commodity index, items in stock, F. O. B. points, plating information, delivery time, specials, terms, etc. A busy buyer can hang the schedule as a wall sheet or place it under the glass on his desk and thereby have all necessary information conveniently at hand for ready reference.

● LATEST EDITION OF "CHEMICALS BY GLYCO" IS now ready for distribution. Glyco Products Co., Inc., 148 Lafayette St., New York, has again turned out a very comprehensive 96-page catalog describing glycol and glyceryl esters, emulsifying agents, special emulsions, synthetic waxes, synthetic resins and a number of specialties of wide interest and application.

Of considerable interest to all users of waxes are the new synthetic waxes recently introduced by the company and fully described in the catalog. These synthetic waxes, which range in melting point from 85 deg. C. to 135 deg. C., are made from domestic raw materials.

● HARDINGE BROTHERS, INC., ELMIRA, N. Y., HAS recently issued its Golden Anniversary bulletin presenting its line of fully enclosed precision milling machines, lathes, collets, form tools and other machines. Progress of the company is outlined on the back page.

● NATIONAL SAFETY COUNCIL, 20 NORTH WACKER Drive, Chicago, has issued its annual statistical report on accidents in the chemical industry, which shows, among other things, the predominant causes of these accidents and which companies made the best records.

● F. W. DWYER MFG. CO., 565 W. WASHINGTON BLVD., Chicago, Ill., has issued a new bulletin on its transparent plastic stationary draft gages used in heating and power plants, air conditioning units, etc.

● WIDELY DIFFERENT APPLICATIONS OF THE IMP Mill used in drying, grinding, or separating materials to be produced in powdered form, are described in a bulletin from Raymond Pulverizer Div., Combustion Engineering Co., Inc., 1324 N. Branch St., Chicago.

● NEW 84-PAGE, ILLUSTRATED CATALOG COVERING its enlarged line of processing equipment has been issued by the Prater Pulverizer Co., 1882 South 55th Ave., Chicago.

★ ★ ★ *Serves* ★ ★ ★

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★ Disaster Relief

★ First Aid Training

★ Life-saving Classes

★ Nutrition Guidance

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★ Home Nursing Instruction

★ Many Helpful Services

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★ **NEW YORK CHAPTER** ★

American Red Cross

315 Lexington Ave., New York

# Machinery and Equipment

● TABER INSTRUMENT CO. ANNOUNCES A SERIES OF hydraulic and mechanical actuated press equipment with special tooling for shallow and deep-drawing transparent sheet plastic, such as the model shown above.

Many types of transparent containers and other products formerly made with cemented joints can now be drawn to shape without visible seams. It is claimed that containers made by this seamless method are not only attractive, but large quantities are more economically produced than by any other method. A wide variety of designs of this type of equipment is available, ranging from small hand presses, using individual blanks, to full automatic equipment with multi-stage deep die operating from roll material.

● LIGHT-WEIGHT SMALL-DIAMETER DELTABESTON aircraft wire, that can be used to carry power to any part of a plane with the greatest possible safety, has been announced by the General Electric appliance and merchandise department. This wire is reported to be serviceable for storage battery leads, circuit wiring for lamps, wiring for instruments, etc., and to be flameproof, highly resistant to heat and to oil and moisture. It is available in sizes 22 to 2/0, inclusive.

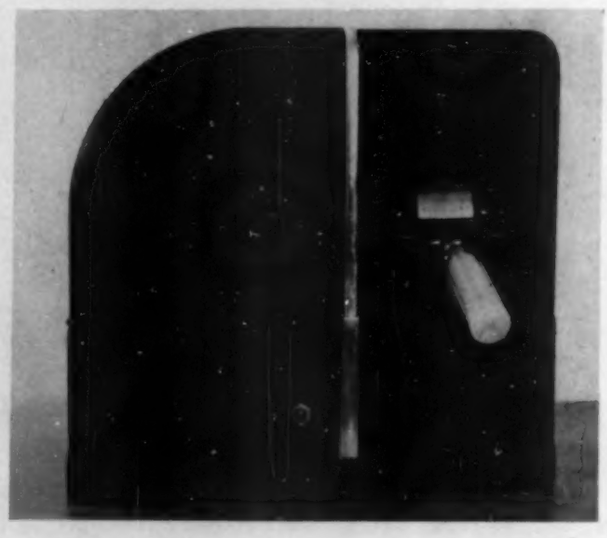
The soft, flexible tinned copper conductor used for this wire is covered by a separator of cellulose acetate or cotton wrap, depending on the size of the conductor. The conductor is insulated with a flameproof synthetic compound and a layer of felted asbestos. The asbestos is impregnated making it highly resistant to moisture and flame. An overall impregnated flameproof braid completes the insulation.

● COMPACTNESS AND IMPROVED PROTECTION ARE two features of a line of d-c motors recently announced by General Electric. A design of rolled-steel frame and improvements in end-shield and bearing-bracket construction are combined to give the motors protection from external damage, it is reported. The use of Formex wire coils and a specially developed Glyptal insulating varnish provide high resistance to impact, abrasion and the action of foreign materials. The motors can be furnished with sleeve or ball bearings.

Open motors are available in constant-speed ratings from $^1/_2$ hp at 850 rpm up to and including 60 hp at 1750 rpm; and, in adjustable-speed ratings from $^1/_2$ hp at 850/3400 rpm up to and including 15 hp at 500/1800 rpm. Motors in the larger ratings (beginning at 50 hp, 850 rpm) embody additional features.

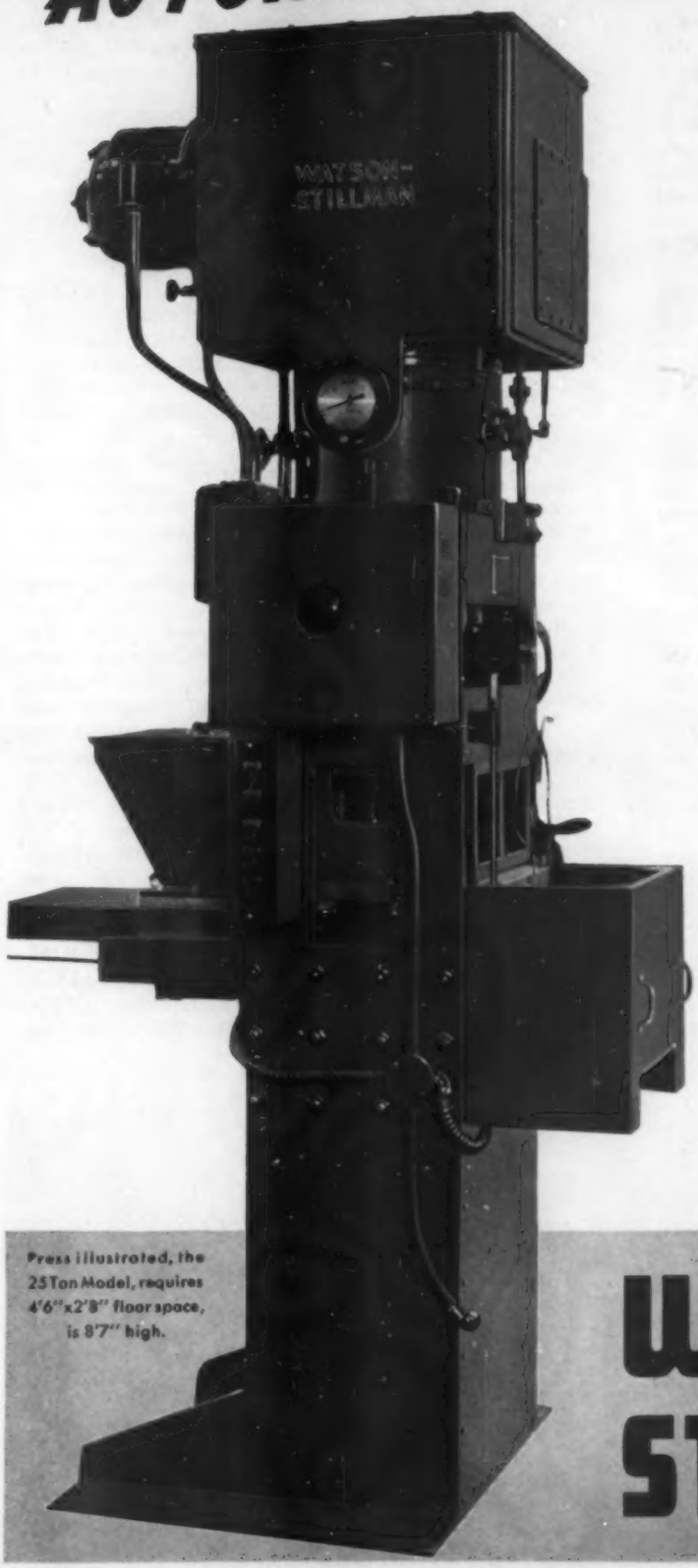
Other features common to the entire line include lower $WR^2$; small diameter, which means low headroom; reversal without changing any parts of the frame, fan, or brush rigging; and laminated plastic wedges in armature slots to protect windings.

● A NEW DEVELOPMENT IN THE TRADEMARKING field is the model PLB (shown below) made by the Markem Machine Co. The ability of the machine to put two color imprints in one operation on almost any object or surface regardless of size or shape opens new fields for economical, attractive decorations and trademarks, it is claimed. Colors and designs can be changed in two or three minutes. Correct registration of color and proper location of imprints can be accurately controlled. Special mounted rubber printing plates and marking compounds are employed. The work is accomplished through the use of a hand-operated synthetic rubber roll in conjunction with motor-driven reservoirs and rubber plate holding arrangements so constructed as to provide accurate registration of the two color work. Compact and lightweight, the machine can be moved from place to place as the work demands.



● HAND-OPERATED TIRE SPREADERS AND HYdraulic spreaders for use wherever quick inspection of tires is necessary are being manufactured by C. E. Miller Mfg. Corporation. The double-spread, hand-operated type is especially useful in retread and recap shops for inserting and removing the curing tubes and collapsible rims in tires. The spreader is strong being made of steel and malleable iron. It is mounted on legs at a convenient height to operate. It is portable and has 6 adjustments so that any size tire from pleasure car tires to truck tires up to 9.00 size can be quickly spread. The hydraulic spreaders are pedal operated. They are powerful, quick acting and portable, and easy to use.

# AUTOMATIC COMPRESSION MOLDING




Press illustrated, the 25 Ton Model, requires 4'6" x 2'8" floor space, is 8'7" high.

• A new, fully automatic, self-contained press • Larger die space—will accommodate single or multiple cavity molds up to 20" x 20" • Faster operation—quick opening and closing—shorter cycle • Centralized controls—timing of all molding operations—greatly simplified • Positive action safety devices—prevent damage to machine or mold • Rapid mold changes—ideal for short as well as long runs • Lower operating costs—for example, 25-ton press requires only 2 H. P. motor • Write for complete information about these new presses.

THE WATSON-STILLMAN CO., ROSELLE, N. J.

## Specifications

| | 25-ton | 50-ton | 75-ton |
|---|---|---|---|
| Capacity of Hopper, lbs. | 25 | 40 | 40 |
| Die Space, inches . . . | 15 x 15 | 20 x 20 | 20 x 20 |
| Stroke, inches . . . . | 6 | 8 | 8 |
| Vertical Opening, inches | 15 | 17 | 17 |
| Maximum Hydraulic Working Pressure, lbs. per sq. in. . . . . | 900 | 900 | 900 |
| Weight, lbs. (approx.) . . | 4000 | 7000 | 9000 |
| Motor, H. P. . . . . | 2 | 3 | 5 |

# WATSON-STILLMAN

# In The Limelight

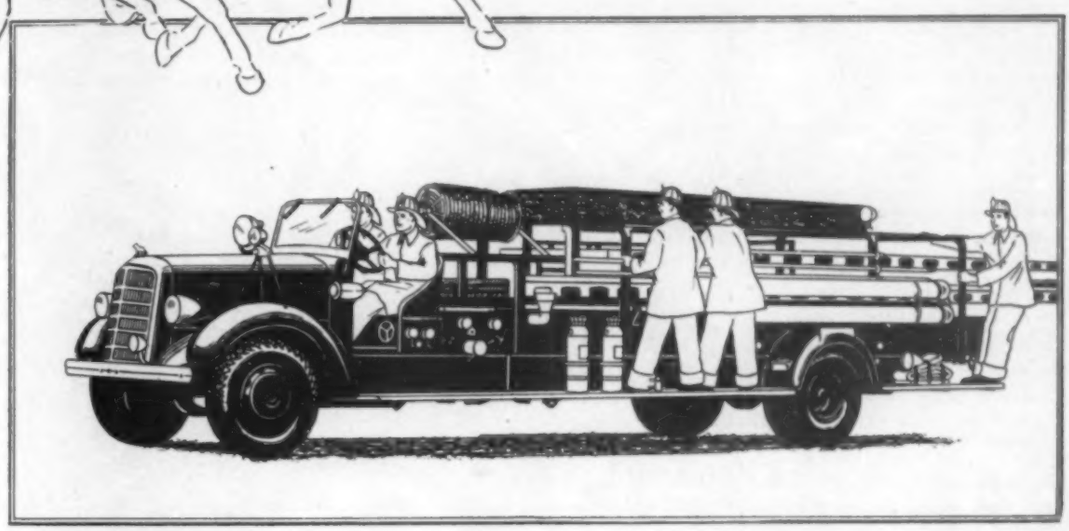
● THE SOCIETY OF THE PLASTICS INDUSTRY HELD its Fall Meeting at Buckwood Inn, Shawnee-on-Delaware, Pa., on October 13th, 14th and 15th. The meeting was well attended. There were more registrants than ever before in the Society's history. Announcement was made at the meeting of the opening of the New York office at 295 Madison Avenue. The Society now has a full-time staff with George Sicard as Executive Secretary assisted by Miss Rita Widemann who is regularly on hand in New York.

Mr. Sicard will spend much of his time in the field. One of the important developments of the meeting was the formation of sectional groups within the Society. These include a molders' division, a raw material manufacturers' division and a machinery division. The membership feels in making this arrangement that it will facilitate the operations of the organization and that in time to come as the Society grows and assumes more responsibilities, this plan will facilitate organization operations.

The following Committees were appointed: *Membership Committee*, C. W. Blount, H. S. Spencer, W. F. Torres, E. Maywald, J. M. Connors, N. A. Backscheider, W. B. Hoey, E. F. Lougee, Elmer E. Mills, Wm. T. Cruse, Chairman. *Molders' Section:* Kenneth W. Macksey, Chairman, George K. Scribner, Secretary, Donald Dew, Coordinator. *Material Manufacturers' Section:* C. J. Romieux, Chairman and Coordinator. *Machinery Manufacturers' Section:* Mr. E. A. Stillman, Chairman. W. B. Hoey Chairman of Entertainment for Spring Meeting.

Members and their guests who registered at the meeting were: Accurate Molding Co.: Alex Adenbaum, Leo Adenbaum; American Cyanamid Co.: W. N. Finney, W. H. MacHale, G. W. Patterson, C. J. Romieux, F. H. Sorensen, W. F. Torres, M. V. Wright; American Insulator Co.: W. S. Grove; American Optical Co.: Herbert Hasenzahl; American Plastics Corp.: C. S. Lawrence; Armstrong Cork Co.: John D. Braught; Arrow-Hart & Hegeman Electric Co.: George W. Carlson; Associated Attleboro Manufacturers, Inc.: C. W. Douglas; Auburn Button Works, Inc.: George P. Anderson, W. A. Freyer; Bakelite Corp.: C. W. Blount, R. E. Brannan, Allan Brown, Gordon Brown, Sandford Brown, David M. Buchanan, W. B. Hoey, D. A. Munns; Barrett Co., The: L. T. Sutherland; Boonton Molding Co.: F. K. Davidson, C. F. Landsheft, R. W. Post, George K. Scribner; Catalin Corp.: Harry Krehbiel, William Theile; Celluloid Corp.: Millard Demarest, W. R. Porter, Edward William Ward; Chicago Molded Products Corp.: Edward F. Bachner, John J. Bachner, M. C. Bachner, James E. Johnston, E. C. Maywald; Columbia Protektosite Co.: Joe Brunetti; Consolidated Molded Products Corp.: E. W. Birney, Henry B. Potter; Diemolding Corp.: Donald H. Dew, Wallace B. Ross, Norman L. Stafford; Dunning & Boschert Press Co.: Donald V. Boschert; E. I. du Pont de Nemours & Co., Inc.: Roberts W. Brokaw, Leslie B. Gillie, F. H. Hoyt, Charles H. Hunton, H. W. Paine, Walter E. Rahm, R. M. Slipp; Durez Plastics & Chemicals, Inc.: R. W. Bainbridge, A. W. Hanmer, Jr., C. H. Kitchen, H. S. Spencer; Durite Plastics: F. A. Morlock; Electrical Manufacturing: E. R. Searles; Laurence Freeman Associates: Laurence Freeman; General Electric Co.: T. E. Giblin, William H. Milton, Jr.; General Industries Co.: Allan W. Fritzsche; Hercules Powder Co.: J. J. B. Fulenwider, Theodore Marvin, P. F. Robb; Injection Molding Corp.: Nicholas Klein, Dan D. Whyte; Irvington Varnish & Insulator Co.: W. F. Hoffmann, Jr., Arthur E. Jones, Douglas Ward; Kuhn & Jacob Moulding & Tool Co.: Eugene Jacob, George Kuhn; Kurz-Kasch, Inc.: Charles H. Frantz, Henry J. Kasch; Leviton Manufacturing Co.: J. C. Swanson; Mack Molding Co.: S. I. Howell, Kenneth W. Macksey, James McIntosh; Makalot Corp.: M. M. Makeever, R. McLaughlan, C. R. Olson; Elmer E. Mills Corp.: Elmer E Mills; Monsanto Chemical Co.: John H. Clark, Charles Lichtenberg, Arnold C. Martinelli, Russell T. Moore, J. R. Turnbull; Modern Plastics: P. H. Backstrom, C. A. Breskin, Alan S. Cole, J. M. Connors, William T. Cruse, G. M. Kline, M. A. Olsen; Niagara Insul-Bake Specialty Co.: Ronald Kinnear, A. R. Van Horne; Nixon Nitration Works: J. D. Clark, H. A. Hendrickson, M. W. Peters, W. B. Savage; Northern Industrial Chemical Co.: Fred C. Meacham, Hans H. Wanders; Norton Laboratories, Inc.: J. B. Neal, H. G. Valentine; Owens-Illinois Glass Co.: George W. Clark; S. Pellerano: Charles N. Gardner; Plaskon Co. Inc.: Alfred Egerter, R. B. Harrison, Joseph A. Joyce, R. M. McGee, James L. Rodgers, Jr., Whiting N. Shepard, Horton Spitzer, C. B. Wing; Plastic Products, Inc.: Emile Hemming; Plastics, Inc.: George J. Crosman, Jr.; Plastics Industries Technical Institute: Ralph Hemphill, E. F. Lougee; Product Engineering: G. F. Nordenholt, John Sasso; Recto Molded Products Corp.: N. A. Backscheider; Reed-Prentice Corp.: F. W. McIntyre, F. W. McIntyre, Jr., G. W. McIntyre; Reilly Tar & Chemical Corp.: William J. Dunnican; Richardson Co., The: Paul Tietz; Röhm & Haas Co.: Kenneth Atwater, D. S. Frederick, D. S. Plume; John Royle & Sons: Kenneth Vandenbree; Shaw Insulator Co.: Harry W. Hahn, Frank Shaw, David H. Smith; Society of Plastics Industry: George H. Sicard; F. J. Stokes Machine Co.: Charles Boss, A. A. Hutchings, Robert Platt, John A. Silver, E. S. Walker; Tennessee Eastman Corp: S. E. Palmer, W. L. Searles, D. C. Williams; Union Carbide & Carbon Corp.: George C. Miller; (*Please turn to next page*)

# Equipment MAKES THE DIFFERENCE



THE old horse drawn fire engine was spectacular, BUT, woefully slow and inefficient compared with our modern fire-fighting apparatus.

**OBSOLETE EQUIPMENT JUST CAN'T MEET TODAY'S DEMANDS.**

And so it is with the molder of Plastics.

He must, like Chicago Molded Products Corp., have plenty of modern equipment.

He must have a large number of all sizes of presses, comprising both compression and injection types.

He must have a staff of expert design and production engineers thoroughly familiar with all molding problems and materials, and experienced in the building of molds.

He must have a well equipped tool room with capable mechanics skilled in precision work.

He must have a department, expert in all phases of finishing, and an inspection force never satisfied except with perfection.

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Universal Plastics Corp.: Bernard Schiller; Valley Molding Co.: Russell Conn, Dan Parks; Vulcanized Rubber Co.: C. J. Luster, Thomas R. Smith; Watertown Manufacturing Co.: J. Harvey Rex; Watson-Stillman Co., The: E. A. Stillman; S. S. White Dental Manufacturing Co.: John P. Case.

● THE FIRST "ONE-PART," PLASTIC RESIN ADHESIVE will soon be available, it is reported, for consumer and industrial users, following the current action of U. S. Plywood Corp. in introducing a new glue under the name of *Weldwood*. It is a urea formaldehyde glue, manufactured under plaskon patents. A similar two-part glue is now being used by big industrial users of adhesive. In the form of a fine powder, *Weldwood* glue is mixed with cold water, in which it is said to dissolve instantly. No separate hardener, or catalyst, is used, nor is heat necessary after application. Hardening in 4 hrs., it provides a bond whose strength has not actually been determined owing to the fact that all tests to date have shown 100 percent wood failure, but no glue failure. Tests on gluing mahogany to pine, calling for a 250-lb. standard reading on the testing machine, showed strengths as high as 2400 lb., at which point the wood gave way.

According to reports, the bond is permanent and waterproof, due to the insolubility of the urea formaldehyde bond after polymerization. Absence of protein elements in the glue precludes development of bacteria, and eliminates fungus and rot. It is stain-free, making its use possible with rare woods, veneers and dyed materials. Jobs glued with the material, it is said, may be handled and worked in two hours; they take on waterproof characteristics in 48 hours, and become completely waterproof after two weeks' aging.

The glue will be marketed in cans from 10 lb. to 300 lb. for industrial purposes, and in 10¢ to 85¢ cans for the domestic user.

● FRANK M. MARTIN, 600 ALDEN ST., SPRINGFIELD, Mass. reports that he is now representing manufacturers of several lines of equipment for the plastics and allied industries in the New England area.

● IT IS REPORTED THAT R. I. POUCHER HAS SUCceeded J. W. Coffman as president of Consolidated Molded Products Corp., Scranton, Pa., and R. J. Atherley has succeeded L. W. Freeman as vice president in Charge of Sales.

● MONSANTO CHEMICAL CO. REPORTS IT HAS BEgun work on engineering plans preparatory to construction in the Detroit Industrial area of a manufacturing plant for the production of peacetime chemicals required by other American industries in the making of products for domestic consumption.

● JAMES F. EPPENSTEIN AND ASSOCIATES, INDUSTrial designers, announce that Harold Malt, B.F.A., graduate of the Carnegie Institute of Technology, Pittsburgh, has recently joined the staff and will be located in the enlarged offices at 35 East Wacker Drive, Chicago.

● AIR ASSOCIATES, INC., ANNOUNCES THE OPENing of its new plant at Bendix Airport, Bendix, N. J.

SORRY!

● WE ARE SORRY THAT HYDRAULIC PRESS MANUfacturing, Co., Mt. Gilead, Ohio, was not given credit for furnishing injection presses in connection with the award-winning Chrysler Corp. instrument panel award in the 1940 Fifth Annual Modern Plastics Competition, as described on page 100 of the October issue and pictured on page 85.

Credit also goes to Wm. R. Thropp & Sons Co. for the hydraulic press used in molding the award-winning Fleming bilge pump described on page 99 and pictured on page 83 of the same issue.

● E. I. DU PONT DE NEMOURS & CO., INC., REPORT that a second plant for the manufacture of nylon yarn will be built at Martinsville, Va. Work is to begin at once. The completed plant, it is said, will employ about 750 persons. The plant is expected to come into production late in 1941, and be in full operation in the spring of 1942.

● THE CHILD-WALKER SCHOOL OF DESIGN IS NOW the Design Department of Stuart School, 1126 Boylston St., Boston, according to a report recently received. Robert Gillam Scott has succeeded Anton Van Dereck as chairman.

● THE SOCIETY OF DESIGNERS FOR INDUSTRY, 50 Rockefeller Plaza, New York, announces the election of William O'Neil, industrial designer, to the office of secretary for the coming year. Other officers are Martin Ullman, president; Frank Gianninoto, vice president; George Blow, treasurer.

● MARTIN ELECTRIC CO., DETROIT, MANUFACTURers of resistance welding transformers, is completing an addition to its new plant on E. Outer Drive. According to William H. Martin, president, the new addition doubles the manufacturing floor space and will add 100 percent to production capacity.

● GLYCO PRODUCTS CO., INC. OF NEW YORK, N. Y., announces the removal of their Philadelphia branch offices to 2000 Franklin Trust Bldg., 15th and Chestnut Sts., Philadephia, telephone, Rittenhouse 2200. Leonard S. Levitt is in charge.

● IT IS ANNOUNCED THAT A BOARD OF GOVERNORS, consisting of men actively interested in the plastics industry, has been organized to guide the educational program at Plastics Industries Technical Institute, 186 So. Alvarado St., Los Angeles, Cal. Members of this board include Donald Dew, Diemolding Corp., Canastota, N. Y.; Dr. Gordon M. Kline, Plastics Division, National Bureau of Standards, Washington, D. C.; Spencer E. Palmer, Tennessee Eastman Corp., Kingsport, Tenn.; and Louis M. Rossi, Bakelite Corp., New York. This board serves in an advisory capacity only and has no part in the administrative operation of the school. The institute held a dinner meeting for the local plastic molding industry on October 2nd. An address entitled "Plastics in National Defense" was delivered by John Delmonte, Technical Director.

● LAWRENCE FREEMAN REPORTS THE ORGANIZAtion of a plastics product engineering firm to be located at 261 Fifth Ave., New York City. The company will represent users of molded and fabricated plastics parts, it is claimed, as well as offer an engineering service incorporating advice on mold design and materials. A laboratory service for various types of accelerated aging and wear tests will also be available.

● WITH ITS PLANT STILL UNDER CONSTRUCTION, but soon to be completed, Neoplastics, Inc., 725 E. Washington Blvd., Los Angeles, Cal., announces its corporation officers: William Wacht, president; Matthew Eggett, vice-president, Chester Stapps, secretary and treasurer. The firm will engage in the manufacture of all types of plastic products and novelties, it is claimed.

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● IT IS WITH DEEP REGRET THAT WE REPORT THE death of Ernst A. Grenquist, Research Chemical Engineer for the Celluloid Corporation of Newark, N. J. Mr. Grenquist was the author of many published papers here and abroad on the dispersion of pigments in rubber, structural changes during processing of rubber, chemistry of the white fir, cataphoresis of bacteria and cellulose acetate plastics. *(Please turn to next page)*

# New!

# South Bend Series "S" Tool Room Precision Lathe

16" x 6' South Bend Series "S" Underneath Belt Motor Driven – Tool Room Precision Lathe.

**TELESCOPIC TAPER ATTACHMENT**

**Turns and bores tapers up to 3½ inches per foot smoothly, easily, and accurately. Telescopic feature eliminates necessity of disconnecting cross feed screw when taper attachment is in use.**

*THE NEW* South Bend Series "S" Tool Room Precision Lathe has been designed and built for efficient service in the modern tool room. Standard equipment includes draw-in collet chuck attachment, micrometer carriage stop, thread dial, chip pan, collet rack, and telescopic taper attachment.

Spindle speeds range from 21 to 725 R.P.M. Quick change gear box makes all threads and feeds instantly available. Large diameter hand wheels, clear-cut easy reading graduations, and conveniently arranged controls reduce operator fatigue, and assure maximum production.

Smooth vibration-free operation at high speed is assured by the direct belt drive to the spindle. A wrenchless bull gear lock permits engaging the back-gears quickly when slow speeds are required for machining large diameters.

Boston Sales Office: 67 Broadway, Kendall Sq., Cambridge, Mass., Tel. Trowbridge 6969
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WE FAVOR ADEQUATE PREPAREDNESS FOR NATIONAL DEFENSE

## SOUTH BEND LATHE WORKS

*LATHE BUILDERS SINCE 1906*

655 E. Madison St., South Bend, Ind., U.S.A.

● DAVID FITZGERALD (ABOVE), WHO FOR THE PAST six years has been auditor of the plastics department of the General Electric Co., has been appointed assistant to G. H. Shill, manager of the department, which has its headquarters in Pittsfield, Mass. Fitzgerald entered the employ of General Electric in 1921, remaining in the general accounting department until 1925, when he became a traveling auditor. E. H. Gabel has been appointed auditor of the department, succeeding Fitzgerald.

● ERICK-GROSS CORP., 381 FOURTH AVE., NEW YORK, has been appointed, for certain eastern states, a representative of the Index Machinery Corp. for the sale of Lester designed injection molding machines, E. Gross, president, reports. This firm is also the export agent for the same type of equipment for all Latin American countries and South Africa.

● F. W. WAKEFIELD BRASS COMPANY, MANUFACturer of commercial lighting equipment, has awarded contracts to the Austin Company for design and construction of a substantial addition doubling the size of its plant in Vermilion, Ohio, it is announced. A. F. Wakefield, president of the company stated that the additional space is needed to handle rapidly expanding business in fluorescent lighting units.

"The superior illumination and low current consumption which characterizes fluorescent tubes had stimulated general modernization of lighting equipment in offices and all types of commercial establishments," Mr. Wakefield pointed out. "This volume, on top of widespread use of fluorescent units in the great majority of new offices, stores and plants is reflected in our current business. Fifty-five percent of our business this year has been in fluorescent units, as against 3 percent last year, while our business in other types has increased about 5 percent. While 1939 was the best year since we entered business in 1907, an increase of 40 percent over last year's volume is now indicated for 1940."

● THE NATIONAL BROADCASTING COMPANY IN collaboration with the Smithsonian Institute of Washington, D.C., as a part of their Public Service Feature Series, "New Wonders of Chemistry," will present a broadcast on Sunday night, November 17, at 10:30 o'clock Eastern Standard Time. The program prepared by the United States Office of Education and the Smithsonian Institute of Washington will depict dramatically many important chemical developments. One of the principal features of the broadcast will be a presentation of plastics developments. A sketch will show how plastics are used by everyone.

● GILBERT L. WOLFE HAS BEEN APPOINTED REPRESentative of the American Nickeloid Co., to have charge of their Schenectady, N. Y., office and to cover central New York state for their prefinished metals according to a recent announcement.

● WILBUR HENRY ADAMS, INDUSTRIAL DESIGNER, reports that he has moved his office from 2014 E. 105th St., Cleveland, Ohio, to R. D. 1, Erie, Pa.

● IT IS ANNOUNCED THAT JESSE H. LIDE HAS BEEN appointed assistant manager of the merchandise advertising and sales promotion of the Westinghouse Merchandising Division.

● THE 61ST ANNUAL MEETING OF THE AMERICAN Society of Mechanical Engineers will be held in New York City, Dec. 2–6, 1940. More than 100 technical papers on such specialized mechanical engineering subjects as aeronautics, applied mechanics, fuels, hydraulics, metals engineering, machine-shop practice, management, materials handling, petroleum, steam power, railroads, textiles, heat transfer and process industries will be presented by leading experts in the field.

● A NEW SOUND-AND-COLOR MOTION PICTURE, "A New World Through Chemistry," recently released by the Public Relations Department of the Du Pont Co. interprets, in 20 minutes of narration and ingenious photography, many of chemistry's newest developments. The picture is offered for club and school showing through the company's motion picture bureau. It may be borrowed either in 16-mm. size on an 800-ft. reel or 35-mm. size on a 2000-ft. reel. There is no charge except the cost of returning the film.

● THE APPOINTMENT OF CHARLES R. PRITCHARD and Ralph J. Brown as vice presidents of the General Electric Supply Corp., Bridgeport, Conn., has been announced by John L. Busey, president. T. F. Hall, who has served during the past year as a member of the merchandising services staff of the G-E radio and television department, has been appointed California field specialist in radio and television receivers and tubes with headquarters in Los Angeles.

● ANNOUNCEMENT IS MADE OF THE OPENING OF Extruded Plastics, Inc., 9 Connecticut Ave., Norwalk, Conn. Charles Slaughter is president.

● BY USING A PROCESS DEVELOPED BY THREE NEW York inventors, shells of cashew nuts may be used as source of a useful resin, according to a report in the bulletin of the National Farm Chemurgic Council. The resin is produced by a heating process applied to the oil extracted from the shells. Resins have wide industrial application in the manufacture of plastics, in the conversion of vegetable oils with no drying qualities into semi-rapid drying oils for use in the manufacture of paints and varnishes, and weatherproofing imitation rubber and leathers.

● GENERAL ELECTRIC CO. EMPLOYEES WHO ARE called for military service or those who voluntarily enlist for the 12 months' training period will receive a full month's pay and be granted a year's leave of absence, it was announced by Charles E. Wilson, president of the company. Only employees with one year or more of continuous employment with the company will be eligible to receive this adjustment.

● WILLIAM W. CALIHAN, FORMER DISTRICT MANager at Rochester, N. Y., for H. K. Porter Co., Inc., has been transferred to Pittsburgh to handle sales of the process equipment division, it has been reported.

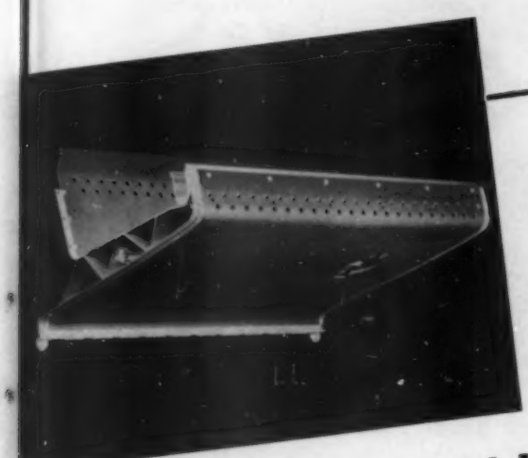
THIS APPLICATION OF **FYBR-TECH** WON

# HONORABLE MENTION

IN THE FIFTH ANNUAL MODERN PLASTICS COMPETITION

**QUESTION:** *When is a Luggage Rack an Air-Conditioning Conduit?*

**ANSWER:** *It is in the* **600** *New Greyhound Coaches... Thanks to* **FYBR-TECH** *made with* **PEERLESS INSULATION** (National Vulcanized Fibre) *by* **TECHNICAL PLY-WOODS**



## *What* FYBR-TECH *is and why it is the* Ideal Material for Luggage Racks and Many Other Uses

"Fybr-Tech," made by Technical Plywoods, 228 North La Salle Street, Chicago, Ill., consists of two sheets of "Peerless" Insulation (National Vulcanized Fibre), bonded with resin in a hot plate press by high heat and heavy pressure to a sheet of thin wood.

In making the luggage rack, shown above, the sheets are made in exact panel size. Then they are fabricated: the lamp holes stamped, the thousands of 1/8-inch holes for air conditioning punched, and the larger holes drilled. The panels then are bent to the proper forms. The bottom face of the upper panel and the upper face of the lower panel combine to make the air conditioning conduit. The resin bond provides 100% adhesion against moisture.

"Fybr-Tech" is ideal for this application due to the characteristics of "Peerless" Insulation (National Vulcanized Fibre) which are: Great Mechanical Strength, Light Weight, High Dielectric Strength, Excellent Flexibility (Bends of 1-inch radius are simple), Ease of Fabrication, Fine Painting Surface.

"PEERLESS" Insulation (a grade of National Vulcanized Fibre), because of its great mechanical strength and excellent electrical properties, is constantly demonstrating its worth as the practical material for countless new uses in industry. And National engineers are demonstrating also their ability to work with technical men in all lines of business in the development of better products through the use of National Vulcanized Fibre and Phenolite, laminated bakelite. We invite your inquiry.

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# NATIONAL VULCANIZED FIBRE CO.

Offices in Principal Cities

WILMINGTON DELAWARE

# Our London Mail Box

*From the heart of the British Empire, London, comes news of plastics and the Battle of Britain. Our own London correspondent, John S. Trevor, is managing through the able assistance of his wife to keep up his periodical reports to us. Another letter that we think enlightening and heartening is that of M. D. Curwen, editor of "Plastics." The plastics industry in England is apparently going strong—just like the bravery and courage of the island's people. It will be interesting to hear the real story of the progress and development of plastics abroad after the war is over. In the meantime, these sidelights are significant. (The Editor)*

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THE warning note of uncertain pitch—in other words, the air raid siren—is today the most hated sound in Great Britain because it presages an immediate but uncertain period of great danger, waste of precious time and considerable personal inconvenience. The business executive may be dictating a highly confidential report one minute, and five minutes later helping to pacify a terrified child in a public air raid shelter. The time-worn old tag that familiarity breeds contempt is most certainly true of the present Nazi bombing raids. A month ago the siren paralyzed industry by causing a complete evacuation of workers to the shelters. Today, however, the workers prefer to carry on as usual and take their chance. The Look-Out Man on the roof gives what is known as an "Immediate Danger Alarm" if he sees bombs falling in the immediate vicinity or hostile aircraft flying dangerously low, but otherwise the wheels of industry do not slow down.

Thanks to an accidental policy of decentralization the British plastics industry has escaped practically unscathed from Nazi bombing raids. True, all branches of the home industry have suffered a good deal of dislocation through slow mails and some disorganization of transport in the southern areas of the country, but the main material manufacturing and molding plants in Great Britain are still intact and production has been speeded up in all directions to keep pace with increasing tempo of rearmament. Looking back over the last few years it seems more than a little ironic that the plastics industry, which catered largely to the fancy goods and luxury trades, should now be making such vital contributions to the war machine. The Air Ministry is today the most important and also perhaps the most impatient customer the industry possesses, and it may be that the War Office will soon be placing fairly substantial orders. The importance which the British Government attaches to the war-time expansion of the plastics industry is indicated by the appointment of a Controller of Plastics whose task it will be to insure that the supply of raw material is fairly distributed.

Since the air blitzkrieg commenced many of the large plastic concerns in southern and eastern England have withdrawn their administrative departments to the country. It will be remembered that a somewhat similar move was carried out at the beginning of the war, but as the expected air offensive did not take place the evacuation of executive departments was abandoned. The present move is one designed to be permanent for the duration of the war.

There is now a tremendous demand for all types of wire reinforced cellulose acetate sheet material to replace broken glass windows in both civil and military buildings. It is realized that it is useless to put in fresh glass and the anti-percussion acetate sheeting offers the only reliable alternative. American suppliers of blast-resisting window glazing might give consideration to the present needs of this island.

In unofficial circles there has been some talk about the pooling of certain types of molding plants, so that molders not using various machines could place them at the disposal of colleagues possessing inadequate plants but definite orders. This scheme, if it ever works out to fruition, will insure considerable economy of plants and also greatly increased production. Naturally some central organization will have to be set up to deal with all aspects of the problem and it may be that this same organization will be able to arrange the pooling of tools. The government is known to be anxious to encourage the re-orientation of the plastics industry on lines more in keeping with wartime economy.

September 9, 1940 — John S. Trevor

---

Dear Mr. Cruse,

I had intended writing you many weeks ago, but, owing to the blitz-krieg, much has remained undone. What with dodging ordinary bombs and our own anti-aircraft shrapnel and with time bombs next door to this office and in the garden at home, modern civilisation, as forced on us by our friends the Boche, has made us perhaps more agile, but also a bit dilatory. Besides, *Plastics* must come out and that comes first.

May I then offer my belated, but sincere congratulations on taking up your new post and I trust that the state of co-operation that has long existed between our two journals will continue. My admiration for MODERN PLASTICS is unbounded.

The plastics industry here is extremely busy and when the whole story is told after the war, I think it will be an exciting one, with new ideas falling over themselves, some very good, some poor, and even some amusing ones. Certainly the industry has a great chance of showing its medals and I hope it will be able to retain some of the business it has got through the shortage of metals.

Unfortunately, real research, other than that for military purposes, goes by the board in a nation at war; no doubt the U. S. A., where it continues, will reap the advantage in the years to come. Life here, as you may imagine, is a bit hectic. We have about 4 or 5 air raids a day while at the office, but we have happily got to the situation where we work through it all until they are overhead, when some of the workers troop down for a few minutes to our dug-outs, and then up again when the bombers have dropped their bombs. On the whole, very little damage has been caused, except, of course, when the Germans have hit really military objectives, such as a hospital, a row of workmen's flats, a school or a candy-store. The most amazing part about it all is that we can get about with almost the freedom of pre-war. Bus, tram and underground services are almost intact. No, perhaps the most amazing part of this London blitz-krieg is the manner in which the Cockney takes it all. His staggering sense of humour is stronger than ever, and, moreover, he has worked up a cold fury against the Nazis. He works hard during the day, and at night, with odd hours of sleep, acts as an Air Raid Warden, Ambulance Driver, Home Guard or Roof Spotter with an enthusiasm and unselfishness nobody (least of all Britons) would have believed possible. The same, of course, happens in the other towns and rural districts. Truly, the Germans have never understood the British mentality or character and, please God, it will prove their undoing.

Remarkable, too, is the warmth of feeling this country has for the United States. Not so much, I feel, because of the material help that the U. S. can give and is giving, but, and rather different from the war of 1918, because of the real similarity of basic ideas of conduct that have been expressed on your side. We felt that it was the hand of friendship, as much as the 50 destroyers, that we took.

Yours very sincerely,

4th October, 1940 — M. D. Curwen, Editor of *Plastics*

FOR EDITORIAL ACHIEVEMENT
1 9 4 0
Award of Merit to
Modern Plastics
for the best single article or editorial
published during the twelve months
ending July 31, 1940
in the third annual competition
conducted by
INDUSTRIAL MARKETING

# Plastics on wheels

(*Continued from page 35*) To give a composite picture of plastic applications we are listing the molded and laminated parts found on a 1941 Buick Series 50, with weights:

| Weight in Lbs. | Specification | Part Name and Usage |
|---|---|---|
| .06 | Cellulose | Knob, Shroud Vent. Handle |
| .028 | Phenolic Laminated Cotton Duck | Washer, 3/8—Trans. Shift Rod to Control Shaft Lower Lever |
| .001 | Phenolic Laminated Cotton Duck | Washer, Insul.—Gas Tank Gauge Unit |
| .002 | Phenolic Resin | Washer, Insul.—Frt. Fdr. Lamp Socket |
| .002 | Phenolic (Black) | Washer, Insul.—Frt. Fdr. Lamp Socket |
| .002 | Phenolic Resin | Plates, Terminal—Frt. Fdr. Lamp |
| .002 | Phenolic Laminated Cotton Duck | Washer, Hd. Lamp Terminal Block Insul. |
| .06 | Phenolic | Body, Hd. Lamp Terminal Block-Insul. |
| .17 | Methylmethacrylate | Lens, Direction Signal Lamp and Tail Lamp |
| .03 | Brown Phenolic Resin | Assy. Distr. Coil Ground Wire Insulators—Point Bushing—Point Friction Pad—Point Terminal Insulating Pad |
| .03 | Phenolic Resin | Relay Horn—Insulating Pads |
| .06 | Black Phenolic | Assy., Voltage and Current Regulator—Insulating Sheets and Tabs |
| .06 | Black Phenolic | Assy., Resistor—Ignition Coil Wire (Spec. Equip.) |
| .018 | C. E. F. No. 540 Natural Phenolic | Washer, Water Pump Seal |
| .07 | Methylmethacrylate | Crystal, Steer. Wheel Monogram |
| .01 | Phenolic Laminated Cotton Duck | Assy., Flasher and Bracket—Insulating Washer |
| .04 | Cellulose Acetate | Knob, Trans. Control Lever |
| .001 | Phenolic Laminated Cotton Duck | Washer, Trans. Selector Rod to Selector Control Lever |
| .02 | Cellulose Acetate | Ring, Steering Wheel Cap Trim |
| 1.25 | Cellulose Acetate | Assy., Steer. Wheel |
| .001 | Phenolic | Washer, Cigar Lighter Base Assy. |
| .01 | Phenolic Laminated Cotton Duck | Fuse, Cigar Lighter—Washers |
| .05 | Cellulose Acetate | Assy. Radio Receiver Tuner Buttons |
| .0001 | Foil Laminated Pyroxylin | Push Button Tabs |
| .001 | Cellulose acetate | Pointer Back Plate |
| .002 | Phenolic Laminated Cotton Duck | Washer, Trans. Control Shaft Insulating, Upper End |
| .002 | Phenolic Laminated Cotton Duck | Washer, Trans. Control Shaft Insulating, Lower End |
| .02 | Paper Base Phenolic | Assy. Head Lamp Terminal Block |
| .01 | Cellulose Acetate | Assy. Radio Control Knob |
| .03 | Cellulose Acetate | Assy. Antenna Control Knob |
| .005 | Phenolic | Insulator, Antenna Front |
| .02 | Phenolic | Assy. Stop-Antenna—Body |
| .002 | Phenolic Laminated Cotton Duck | Insulating Washer — Instr. Panel Light Switch |
| .0015 | Phenolic Laminated | Insulator, Horn Contact Plate |
| .0018 | Phenolic Laminated | Washer, Horn Contact Plate Insulator |
| .002 | Phenolic Resin | Switch, Hydraulic Stop Light Insulator |
| .0001 | Methylmethacrylate | Assy. Electric Clock—Panel |
| .02 | Cellulose Acetate | Dial back |
| .32 | Phenolic | Cap, Distributor |
| .001 | Phenolic Laminated Cotton Duck | Washer, Insulating—Gas Gauge Tank Unit |
| .01 | Methylmethacrylate | Ring, Figure—Oil and Gas Gauge Assy. |
| .02 | Celluose-Acetate-Butyrate | Target, Oil and Gas Gauge. Target, Temp. and Ammeter Gauge |
| .01 | Methylmethacrylate | Ring, Figure—Temp. and Ammeter Gauge |
| .001 | Phenolic Laminated Cotton Duck | Base, Contact Strip—Gas Gauge Tank Unit |
| .0005 | Phenolic Laminated Cotton Duck | Insulator, Contact Strip Assy.—Gas Gauge Tank Unit |
| .01 | Phenolic | Washer, Thrust—Speedo, Cable |
| .02 | Methylmethacrylate | Ring, Figure—Speedo Assy. |
| .03 | Cellulose | Face, Speedo |
| .0005 | Methylmethacrylate | Window, Tell Tale—Speedo Assy. |
| .002 | Methylmethacrylate | Pointer, Speedo |
| .001 | Phenolic | Bushing, Insulator — Cigar Lighter Wire Assembly |
| .001 | Phenolic Laminated Cotton Duck | Washer, Insulating—Cigar Lighter Wire Assembly |
| .06 | Phenolic | Top, Coil |
| .005 | Black Phenolic | Bushing, Terminal Ign.—Switch and Cable |
| .001 | Brown Phenolic | Bushing, Insulating—Dome Light and Fuse Holder Wire |
| .01 | Black Phenolic | Support, Contact—Lighting Switch |
| .018 | Phenolic Laminated Cotton Duck | Washers, Insulating Wiring System |
| .005 | Phenolic | Bushing, Insulating—Wiring System |
| .003 | Brown Mldg. Mat. | Bushing, Wire |
| .001 | Phenolic | Assy., Bushing—Ash Tray Lamp |
| .01 | Phenolic Resin | Assy., Lighting Switch Back—Insulating Base |
| .01 | Black Phenolic | Support, Contact—Direction Signal Switch |
| .001 | Black Phenolic | Sleeve, Switch—Direction Signal Switch |
| .02 | Phenolic | Assy. Contact—Ign. Switch and Cable |
| .06 | Phenolic | Base, Coil—Cam Assy. |
| .03 | Phenolic | Insulator, Six-Way Connector in Wiring Harness Assembly |
| .01 | Cellulose | Knob, Direction Signal Switch Lever |
| .002 | Phenolic Laminated Cotton Duck | Washer, Insulating—Direction Signal Switch Wire Assy. |
| .005 | Phenolic Resin | Assy., Vibrator Horn—Low—Right Terminal Block Insulating Pads |
| .001 | Brown Mldg. Mat. | Terminal Insulating Sleeve |
| .005 | Phenolic Resin | Assy., Vibrator Horn—High—Left Terminal Block Insulating Pads |
| .001 | Brown Mldg. Mat. | Terminal Insulating Sleeve |

(*Please turn to next page*)

TACKLING your molding problem
. . . with modern, up-to-date molding methods and the latest high-speed injection and compression presses.
We offer, as well, a complete, well-rounded and well-integrated molding service from design, through mold-making and finishing. Routine production of the most difficult molding jobs insures perfect satisfaction on your job.
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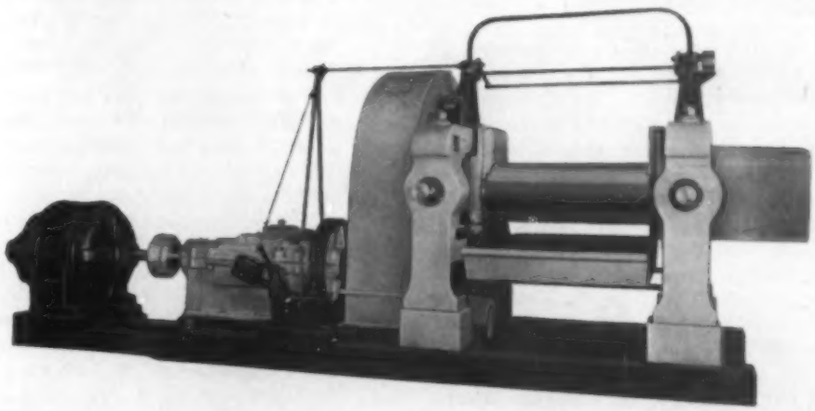
Write for FREE 48-page book giving basic plastics data.

Here Is Our Latest Design
In Mixing Mills for Plastics



A High Speed, Extra Heavy Duty 16" x 42" Mill

Incorporating—125 H P, Enclosed Herringbone gear drive, 13" Roll Bearings with New Style Force Feed Lubrication. Water Cooled Bearings or Internally Bored Rolls Optional.

WRITE FOR ADDITIONAL INFORMATION

WM. R. THROPP & SONS CO.

TRENTON, N. J. Established 1888

| Weight in Lbs. | Specification | Part Name and Usage |
|---|---|---|
| .02 | Phenolic Resin | Switch, Dimmer—Contact Pad and Rotor Disc |
| .002 | Phenolic Laminated Cotton Duck | Washer, Insulating—Defroster Switch P. A. |
| .002 | Phenolic Laminated Cotton Duck | Washer, Insulating—Underseat Heater Switch P. A. |
| .01 | Black Phenolic | Sleeve and Body—Connector—Defroster—Motor Wire Extension |
| .04 | Methylmethacrylate | Tail light diffusing lens |
| .06 | Methylmethacrylate | Signal light diffusing lens |
| .02 | Methylmethacrylate | Trunk light lens |
| .03 | Urea-Formaldehyde | Dome light lens |
| .04 | Cellulose | Door handle escutcheons |
| .08 | Cellulose | Window regulator escutcheons |
| .06 | Cellulose | Window regulator knobs |
| .04 | Cellulose | Rear seat ash tray knob |
| .01 | Cellulose | Rear seat cigar lighter knob |
| 3.193 | Approx. Total | |

In all cases the specifications which have been drafted are not necessarily final. In some instances they are only intended to guide, in others they are rigidly enforced. In time to come they will undoubtedly be more rigidly drawn. When they are it will be within the reasonable commercial limits of the respective materials.

### Detail of specifications

In the interest of reporting exactly the character of the specifications which are beginning to appear, typical examples are here reproduced. They are published through the generous courtesy of the companies who are credited. As pointed out, these specifications mark a trend. While today, they both govern and guide, in the rapidly changing plastics and automobile industries, alterations may be anticipated.

### Chrysler Corporation

The following plastic material standards are not intended or thought to be exhaustive either in their methods of control or in the complete analysis of possible trouble. The use of plastics in automobiles, although over a fairly long period, offers such unusual conditions to the manufacturer and molder that difficulty is sometimes experienced in assigning other than general conditions within which experimental work must be done to determine the specific properties desired before production can be started. In view of this, these standards represent a framework upon which more detailed specifications for performance are drawn. In any case they offer a path by which mutual cooperation between raw material manufacturers and the Chrysler Corporation may arrive at an equitable compromise for all parties concerned.

If a plastic has good heat resistance, low shrinkage in subzero temperatures, low loss of plasticizer, and sufficient strength to withstand handling and assembling conditions, trouble of any serious extent will not come up.

#### PLASTIC MATERIAL STANDARDS

***Plastics—Decorative—Not in Contact with Lacquer***

1. This specification covers decorative plastics for interior use in locations where they will not be less than 1/8 in. from lacquer-coated parts.
2. All finished parts must withstand a hot and cold test wherein they are subjected to a temperature of −40 deg. F. for 24 hrs., 175 deg. F. dry heat for 24 hrs., another 24 hrs. at −40 deg. F., and finally 24 hrs. at 175 deg. F. with 65 to 70 percent relative humidity. During this cycle, the piece must not shrink in excess of 2 percent, warp, discolor, or crack under the load or stress required in production usage. The surface shall not craze, become wavy, tacky, or otherwise unsightly.
3. Materials covered by this specification shall have a minimum hardness reading of 70 at room temperature and 60 at 158 deg. F. on the needlepoint durometer in the Chrysler Laboratory.
4. This specification does not specify the flow hardness of the material to be used on any particular part. Each molder must, however, report to the Chrysler Engineering Laboratories the trade name, composition, and flow hardness of the particular material finally approved for each part. Subsequent changes must also be reported.
5. When finished plastic parts are exposed to ultra-violet light in the color fadeometer at a distance of 10 in. from the source of light for 100 hrs., they shall not show fading or change in color greater than that of an approved color sample.
6. The colors of all plastics shall be referred to by Chrysler Plastic Color numbers. Approved color chips for these colors may be obtained from the Chrysler Plastics Laboratory. All samples of plastic materials submitted to match a particular Chrysler color must be approved through the Plastics Laboratory. Such an approval must also be secured by the molder for each individual part before a production quantity is made up.
7. Parts made from these plastic materials shall be so processed, when molded by either the compression or injection method, that no flow lines or welding seams are visible on the completed parts.
8. All finished parts must have the flash smoothly buffed off and the visible surface highly polished.
9. It shall be permissible to use only cellulose acetate and cellulose aceto-butyrate from a list of approved sources for parts covered by this specification.
10. Parts covered by this specification shall be purchased only from an approved list of molders.

***Plastics—Decorative—In Contact with Lacquer***

1. This specification covers decorative plastics for interior use in locations where they will be in contact with or less than 1/8 in. from lacquer coated parts.
2. Plastic materials covered by this specification shall not soften, discolor, or otherwise damage the finish of nitrocellulose lacquered parts with which they are in close contact. A quick test for this property may be made by placing a sample of the plastic material on a lacquered panel in an oven for 24 hrs. at 175 deg. F.
3. All finished parts must withstand a hot and cold test wherein they are subjected to a temperature of −40 deg. F. for 24 hrs., 175 deg. F. dry heat for 24 hrs., another 24 hrs. at −40 deg. F., and finally 24 hrs. at 175 deg. F. with 65 to 70 percent relative humidity. During this cycle, the piece must not shrink in excess of 2 percent, warp, discolor, or crack under the load or stress required in production usage. The surface shall not craze, become wavy, tacky, or otherwise unsightly.
4. Materials covered by this specification shall have a minimum hardness reading of 70 at room temperature and 60 at 158 deg. F. on the needlepoint durometer in Chrysler Laboratory.
5. This specification does not specify the flow hardness of the material to be used on any particular part. Each molder must, however, report to the Chrysler Engineering Laboratories the trade name, composition, and flow hardness of the particular material finally approved for each part. Subsequent changes must also be reported.

*(Please turn to next page)*

# AN ASH TRAY OR A WHISTLING KETTLE

Whether it's a decorative knob as used on Revere Copper & Brass Co.'s *whistling kettle*, a lustrous rim for the unique "Pick-Me-Up" ash tray by the same company . . . or a precise electrical or mechanical part with unusually close tolerances—it's worth your while to take advantage of Auburn's trained personnel and 64 years of sound experience.

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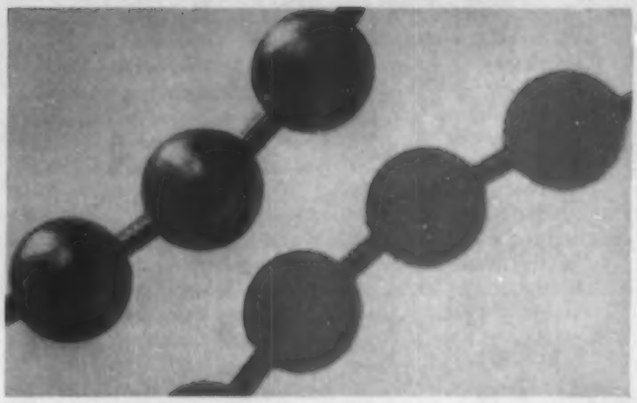

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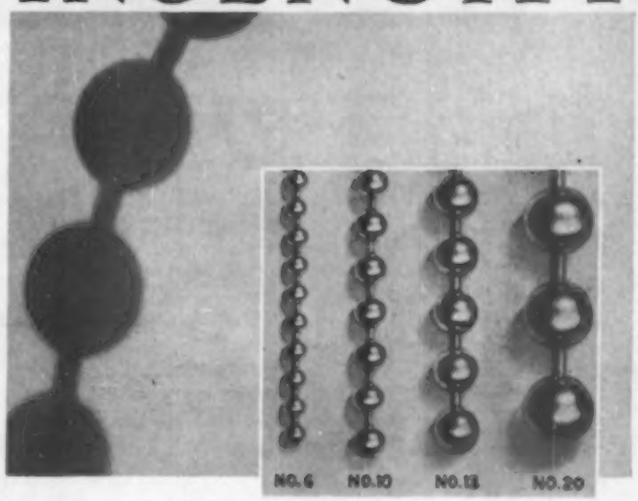


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6. The colors of all plastics shall be referred to by Chrysler Plastic Color numbers. Approved color chips for these colors may be obtained from the Chrysler Plastics Laboratory. All samples of plastic materials submitted to match a particular Chrysler color must be approved through the Plastics Laboratory. Such an approval must also be secured by the molder for each individual part before a production quantity is made.
7. All finished parts must have the flash smoothly buffed off and the visible surfaces highly polished.
8. When finished plastic parts are exposed to ultra-violet light in the color fadeometer at a distance of 10 in. from the source of light for 100 hrs., they shall not show fading or change in color greater than that of an approved color sample.
9. Parts made from these plastic materials shall be so processed, when molded by either the compression or injection method, that no flow lines or welding seams are visible on the completed parts.
10. It shall be permissible to use only cellulose aceto-butyrate from an approved source for parts covered by this specification.
11. Parts covered by this specification shall be purchased only from an approved list of molders or fabricators.

***Plastics—Edge Lighting—Heat Resistant***

1. This specification covers a plastic material for use in interior locations where the transmission of light edgewise through the material is a function of the design and where the heat to which finished parts are subjected will not exceed 185 deg. F. The location of parts made from it must be such that they will never be in contact with organic solvents, such as cleaning fluids.
2. Plastic materials covered by this specification shall not soften, discolor, or otherwise damage the finish of nitrocellulose lacquered parts with which they are in close contact. A quick test for this property may be made by placing a sample of the plastic material on a lacquered panel in an oven for 24 hrs. at 175 deg. F.
3. Materials covered by this specification shall have a minimum hardness reading of 90 at room temperature and 80 at 158 deg. F. on the needlepoint durometer in the Chrysler Laboratory.
4. All finished parts must withstand a hot and cold test wherein they are subjected to a temperature of −40 deg. F. for 24 hrs., 175 deg. F. dry heat for 24 hrs., another 24 hrs. at −40 deg. F., and finally 24 hrs. at 175 deg. F. with 100 percent relative humidity. During this cycle, the piece must not shrink, warp, discolor, or crack under the load or stress required in production usage. The surface shall not craze, become wavy, tacky, or otherwise unsightly.
5. The colors of all plastics shall be referred to by Chrysler Plastic Color numbers. Approved color chips for these colors may be obtained from the Chrysler Plastics Laboratory. All samples of plastic materials submitted to match a particular Chrysler color must be approved through the Plastics Laboratory. Such an approval must also be secured by the molder for each individual part before a production quantity is made.
6. This specification does not specify the flow hardness of the material to be used on any particular part. Each molder must, however, report to the Chrysler Engineering Laboratories the trade name, composition, and flow hardness of the particular material finally approved for each part. Subsequent changes must also be reported.
7. All finished parts must have the flash smoothly buffed off and the visible surfaces highly polished.
8. When finished plastic parts are exposed to ultra-violet light in the color fadeometer at a distance of 10 in. from the source of light for 100 hrs., they shall not show fading or change in color greater than that of an approved color sample.
9. Parts made from these plastic materials shall be so processed, when molded by either the compression or injection method, that no flow lines or welding seams are visible on the completed parts.
10. It shall be permissible to use only polystyrene from a list of approved sources for parts covered by this specification.
11. Parts covered by this specification shall be purchased only from an approved list of molders or fabricators.

***Plastics—Edge Lighting—Low Heat Resistant—Exterior or Interior***

1. This specification covers a plastic material for use on exterior locations where the transmission of light edgewise through the material is a function of the design and where the heat to which finished parts are subjected will not exceed 158 deg. F.
2. Plastic materials covered by this specification shall not soften, discolor, or otherwise damage the finish of nitrocellulose lacquered parts with which they are in close contact. A quick test for this property may be made by placing a sample of the plastic material on a lacquered panel in an oven for 24 hrs. at 175 deg. F.
3. Materials covered by this specification shall have a minimum hardness reading of 90 at room temperature and 80 at 158 deg. F. on the needlepoint durometer in the Chrysler Laboratory.
4. All finished parts must withstand a hot and cold test wherein they are subjected to a temperature of −40 deg. F. for 24 hrs., 158 deg. F. dry heat for 24 hrs., another 24 hrs. at −40 deg. F., and finally 24 hrs. at 158 deg. F. with 65 to 70 percent relative humidity. During this cycle, the piece must not shrink more than 1 percent, warp, discolor, or crack under the load or stress required in production usage. The surface shall not craze, become wavy, tacky, or otherwise unsightly.
5. This specification does not specify the flow hardness of the material to be used on any particular part. Each molder must, however, report to the Chrysler Engineering Laboratories, the trade name, composition, and flow hardness of the particular material finally approved for each part. Subsequent changes must also be reported.
6. The colors of all plastics shall be referred to by Chrysler Plastic Color numbers. Approved color chips for these colors may be obtained from the Chrysler Plastics Laboratory. All samples of plastic materials submitted to match a particular Chrysler color must be approved through the Plastics Laboratory. Such an approval must also be secured by the molder for each individual part before a production quantity is made.
7. All finished parts must have the flash smoothly buffed off and the visible surfaces highly polished.
8. When finished plastic parts are exposed to ultra-violet light in the color fadeometer at a distance of 10 in. from the source of light for 100 hrs., they shall not show fading or change in color greater than that of an approved color sample.
9. Parts made from these plastic materials shall be so processed when injection or compression molded that no flow lines or welding seams are visible on the completed parts.
10. It shall be permissible to use either injection or compression methyl methacrylates from an approved list of sources for parts covered by this specification.
11. Parts covered by this specification shall be purchased only from an approved list of molders or fabricators.

***Plastics—Edge Lighting—Moderately Heat Resistant***

1. This specification covers a plastic material for use in interior locations where the transmission of light edgewise through the material is a function of the design and where the heat to which finished parts are subjected will not exceed 170 deg. F.

(*Please turn to next page*)

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All departments—design, engineering, production, (and even traffic if extraordinary delivery schedules are to be met)—put their heads together to arrive at the best possible solution of your problem. Design, processes and materials all come in for their share of the discussion—and agreed upon before the presses eject their first molding.

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2. Plastic materials covered by this specification shall not soften, discolor, or otherwise damage the finish of nitrocellulose lacquered parts with which they are in close contact. A quick test for this property may be made by placing a sample of the plastic material on a lacquered panel in an oven for 24 hrs. at 175 deg. F.
3. Materials covered by this specification shall have a minimum hardness reading of 90 at room temperature and 80 at 158 deg. F. on the needlepoint durometer in the Chrysler Laboratory.
4. All finished parts must withstand a hot and cold test wherein they are subjected to a temperature of −40 deg. F. for 24 hrs., 175 deg. F. dry heat for 24 hrs., another 24 hrs. at −40 deg. F., and finally 24 hrs. at 175 deg. F. with 65 to 70 percent relative humidity. During this cycle, the piece must not shrink more than 1 percent, warp, discolor, or crack under the load or stress required in production usage. The surface shall not craze, become wavy, tacky, or otherwise unsightly.
5. This specification does not specify the flow hardness of the material to be used on any particular part. Each molder must, however, report to the Chrysler Engineering Laboratories the trade name, composition, and flow hardness of the particular material finally approved for each part. Subsequent changes must also be reported.
6. The colors of all plastics shall be referred to by Chrysler Plastic Color numbers. Approved color chips for these colors may be obtained from the Chrysler Plastics Laboratory. All samples of plastic materials submitted to match a particular Chrysler color must be approved through the Plastics Laboratory. Such an approval must also be secured by the molder for each individual part before a production quantity is made.
7. All finished parts must have the flash smoothly buffed off and the visible surfaces highly polished.
8. When finished plastic parts are exposed to ultra-violet light in the color fadeometer at a distance of 10 in. from the source of light for 100 hrs., they shall not show fading or change in color greater than that of an approved color sample.
9. Parts made from these plastic materials shall be so processed when compression molded that no flow lines or welding seams are visible on the completed parts.
10. It shall be permissible to use only compression methyl methacrylates from an approved list of sources for parts covered by this specification.
11. Parts covered by this specification shall be purchased only from an approved list of molders or fabricators.

***Plastics—Embossed—Printed—Sheets***

1. This specification covers plastics which are completely enclosed for such uses as instrument dial faces. This plastic must not be used in any place where it is exposed to open flame, as it is extremely inflammable.
2. Materials covered by this specification shall have a minimum hardness reading of 80 at room temperature and 70 at 158 deg. F. on the needlepoint durometer in the Chrysler Laboratory.
3. All finished parts coated with synthetic enamel or lacquer must withstand a hot and cold test wherein these are subjected to a temperature of −40 deg. F. for 24 hrs., 175 deg. F. dry heat for 24 hrs., another 24 hrs. at −40 deg. F., and finally at 175 deg. F. with 65 to 70 percent relative humidity. During this cycle, the piece must not shrink more than 2 percent, warp, discolor, or crack under the load or stresses required in production usage. The surface shall not craze, become wavy, tacky, or otherwise unsightly.
4. This specification does not specify the plasticity flow of the material to be used on any part. Each molder must, however, report to the Chrysler Engineering Laboratories the trade name, composition, and the plasticity flow of the particular material finally approved for each part. Subsequent changes must also be reported.
5. When finished plastic parts having a synthetic or lacquer coating are exposed to ultra-violet light in the color fadeometer at a distance of 10 in. from the source of light for 100 hrs., they shall not show fading or change in color greater than that of an approved color sample.
6. The colors of all plastics shall be referred to by Chrysler Plastic Color numbers. Approved color chips for these colors may be obtained from the Chrysler Plastics Laboratory. All samples of plastic materials submitted to match a particular Chrysler color must be approved through the Plastics Laboratory. Such an approval must also be secured by the molder for each individual part before a production quantity is made.
7. Parts made from these plastic materials shall be so processed, when molded, that no flow lines or welding seams are visible on the completed parts.
8. It shall be permissible to use cellulose nitrate from an approved list of sources for parts covered by this specification.
9. Parts covered by this specification shall be purchased only from an approved list of molders or fabricators.

***Plastics—Thermosetting—Synthetic Coated***

1. This specification covers thermosetting plastics having a composition which will not affect lacquer or synthetic enamel finishes that may be applied to certain portions of the surface.
2. Materials covered by this specification shall have a minimum hardness reading of 98 at room temperature and 95 at 158 deg. F. on the needlepoint durometer in Chrysler Laboratory.
3. All finished parts, either plain or coated with lacquer or synthetic enamel, must withstand a hot and cold test wherein they are subjected to a temperature of −40 deg. F. for 24 hrs., 175 deg. F. dry heat for 24 hrs., another 24 hrs. at −40 deg. F., and finally 24 hrs. at 175 deg. F. with 65 percent to 70 percent relative humidity. During this cycle, the piece must not shrink, warp, discolor, or crack under the load or stress required in production usage. The surface shall not craze, become wavy, tacky, or otherwise unsightly.
4. This specification does not specify the plasticity flow of the material to be used on any particular part. Each molder must, however, report to the Chrysler Engineering Laboratories the trade name, composition, and the plasticity flow of the particular material finally approved for each part. Subsequent changes must also be reported.
5. The colors of all plastics shall be referred to by Chrysler Plastic Color numbers. Approved color chips for these colors may be obtained from the Chrysler Plastics Laboratory. All samples of plastic materials submitted to match a particular Chrysler color must be approved through the Plastics Laboratory. Such an approval must also be secured by the molder for each individual part before a production quantity is made.
6. When finished plastic parts having a synthetic coating are exposed to ultra-violet light in the color fadeometer at a distance of 10 in. from the source of light for 100 hrs., they shall not show fading or change in color greater than that of an approved color sample.
7. All finished parts must have the visible surfaces molded very smoothly and the flash fully buffed off.
8. Parts made from these plastic materials shall be so processed, when molded, that no flow lines or welding seams are visible on the completed parts.
9. It shall be permissible to use phenol-formaldehyde molding powders from an approved list of sources for parts covered by this specification.
10. Parts covered by this specification shall be purchased only from an approved list of molders or fabricators.

(*Please turn to next page*)

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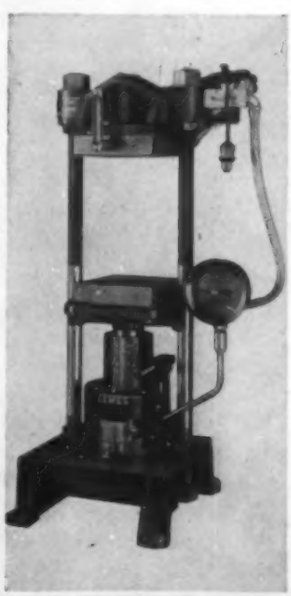

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Lea Technicians, who have been and continue to be so helpful to the metal-working industry, are now spending much of their time on plastic polishing and buffing problems. In placing trial orders, please give details as to the kind of plastic being finished and the operations now being carried out.

## THE LEA MFG. CO.

WATERBURY, CONN.

*Specialists in the Production of Clean-Working Buffing and Polishing Compounds*

(*Continued from page 90*)

**Ternstedt Manufacturing Division General, Motors Corporation**

**Laboratory Material Specification: Specification T-701**

**Plastic Parts Made of Thermoplastic Materials**

*General:*

This specification covers the physical properties of parts made of thermoplastic materials used for decorative purposes in the interior of car bodies. The physical properties considered are: stability to light, heat, moisture and impact. For the present, this specification will limit the thermoplastic materials which can be used to cellulose acetate, cellulose acetate butyrate and methyl methacrylate. Methyl methacrylate thermoplastic compositions are also conditionally considered satisfactory for exterior decorative purposes.

*Scope of Specification:*

While this specification should be considered, in part, as a guide to the vendor in the production of an acceptable product, it is not intended to relieve him of the responsibility of supplying parts suitable for the use specified even though the desired qualities or limits are not stated in this specification.

*Physical Properties:*

After accelerated aging, as described below, the parts shall not show any warping, unmolding, sinks or loss of luster which will affect the practical utility of the part. Cemented surfaces shall be essentially as strong as the rest of the part. Weld lines should not be noticeable enough to detract from the appearance of the part and shall be such that the strength of the part as a whole shall not be reduced to the point that its practical utility is affected.

*Bleeding of Color:*

In no cases, either before, after or during the accelerated aging test, shall the coloring material in the plastic part come to the surface of the part so that it can be rubbed off. When more than one color of plastic material is used in a plastic assembly, there shall be no bleeding of color from one part of the assembly to another.

*Dimensional:*

The net linear dimensional changes caused by accelerated aging shall be not more than .005 in. per inch. This shall be calculated from measurements made after the two conditioning operations.

*Fading:*

*a. Florida Exposure:*

After 30 days' exposure under automobile safety glass in which the inner layer is composed of either cellulose acetate or vinyl acetal to Florida sunshine, color fading, loss of luster or surface cracking shall not be to the extent that the appearance is noticeably affected. Parts used on the exterior of the body shall be exposed for 30 days to Florida sunshine directly with the same qualifications as above after this exposure.

*b. Accelerated Aging Exposure:*

This specification will not include a clause on accelerated light exposure such as to the ultra-violet or sun lamps until such time as a reasonable correlation can be found between it and the Florida exposure test.

*Retention of Knob Inserts:*

The retention of the steel insert in handle knobs after accelerated aging shall not be less than 400 lb. direct pull.

*Blue Print Dimensions:*

The parts as received shall conform to the blue print dimensions and accepted color range and finish which shall be considered a part of this specification.

*Accelerated Aging Test:*

The accelerated aging test shall be made as follows:

1. The parts as received shall be conditioned by exposing them for not less than 48 hrs. to room temperature and a relative humidity of from 35 to 50 percent.
2. The parts after conditioning shall have significant dimensions measured to the nearest 0.001 in. and a careful examination of the parts made.
3. Expose in a suitable cabinet for 24 hrs. at 100 deg. F. and approximately 100 percent relative humidity. Remove excess water with a dry cloth and measure again to within 0.001 inch. Examine for other physical changes.
4. After humidity exposure again expose the parts, this time, however, for 24 hrs. at 140 deg. F. and about 15 percent relative humidity. Measure again to within 0.001 in. and note other physical changes.
5. After dry heat exposure recondition again for at least 48 hrs. at room temperature and a relative humidity of from 35 to 50 percent.
6. Calculate linear dimensional changes in inches per inch from the measurements made after the two conditioning operations.
7. Measurements made after each exposure while not required will give an indication of the character and amount of plasticizer used in the material.

*Packing:*

The parts are to be shipped in cardboard containers.

*Shipping:*

The method of shipping shall be agreed upon by the Purchasing Department and the vendor.

*Marking:*

The container shall be marked with the vendor's name and address, quantity, part number, color number, specification number, purchase order number and gross, net and tare weights.

*Inspection and Rejection:*

While samples may be taken from incoming shipments and checked according to this specification, the vendor must accept the responsibility of shipments meeting the above specification without dependence upon the buyer's inspection which may be done at his option.

Materials failing to conform shall be returned for credit or replacement or other arrangements may be made at the option of the purchaser.

*Sources:*

No shipments shall be made by new sources until sample parts they propose to supply under this specification have been approved by the Laboratory and the Standards Engineering Department.

NOTE: The above specification is given without considering whether patents may be involved. In all cases, therefore, the supplier should be required to assume patent liability.

We feel that the plastic specifications from these two automobile companies are extremely interesting and significant. The motivating objective of all specifications developed has been the desire to keep in mind the commercial limits of the materials and at the same time to encourage the development of the best properties in the respective material groups involved. Such specifications are undergoing constant change. This fact proves that there is an active interest in plastics on the part of this industry, more than that, it proves conclusively that plastics have a vitally important goal to reach in the automotive field.

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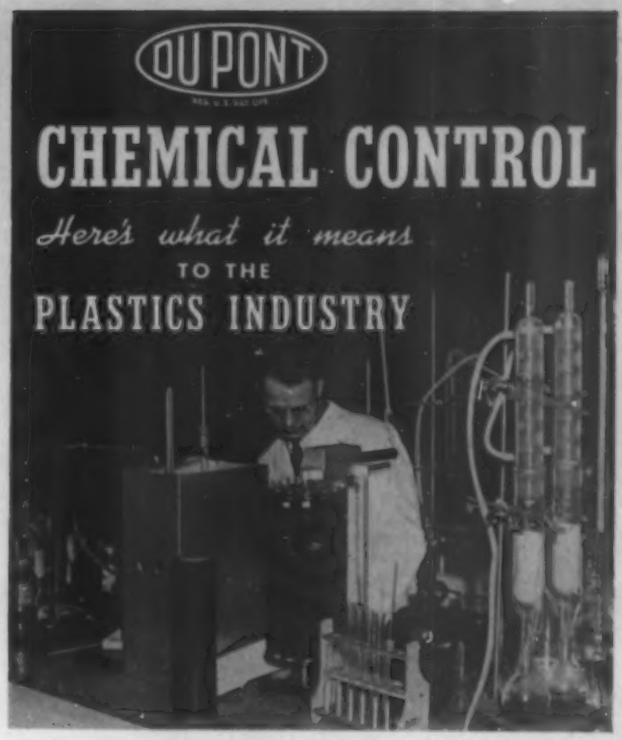


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## Presentation Dinner

(*Continued from page 41*) ahead faster than you do is because *something* is stopping you. You would sell twice as much as you do, if it was not for *something*. The thing that stops research is the auditor. Now, the reason the auditor stops you is because 99.9 percent of all operations in the world are detailed operations. You know what they cost. You know when you are going to get them done. You know when you are going to ship them, and maybe sometimes who is going to pay for them. Now, when you come over to this 1 percent, or half of a percent of the thing you call research, the auditor can't say 'Why, you can't budget!' Why, you do not know how much it is going to be, how much it is going to cost when you are going to get it done, and how much it will be worth.' Consequently, he pins the researcher down to the point where the only thing he can do is mediocre things, and so you can't take the wings of an eagle and look forward to what your industry is going to be. I happen to be very fortunate in the respect that I never have to worry about money, thanks to you customers.

"We divide our research into three things. First of all, services to our division. It doesn't make any difference whether you have one division, two divisions or three divisions—I mean to the active-going industry as it is today. The next thing is more or less advance stuff that the boys are going to need tomorrow, and the third thing is a pretty broad outlook.

"There are undoubtedly some salesmen in this organization. I can see that by your faces. Remember, there is one use of the Research Department. You want to make good use of it. If you ever get in trouble in the field—it is the Research Department's fault. That is right. If there is any one fellow who is going to be lily-white in seeing a customer, it is the salesman. I am not kidding you. I am very practical. You must go out and tell the customer that your Research Department or Engineering Department (there is not much difference between the Engineering Department and the Research Department—research is one notch lower than engineering)—you tell your customer that they made a mistake, and then you bring back the new product.

"I want to mention a thing about the automobile business. I do not want to try to sell you anything. I am the most non-commercial guy in the world, but the only reason that our business has stayed alive is because we have a yearly margin. We know that next year Mr. Ford and Mr. Chrysler and Mr. General Motors are going to be on display, and they are going to compare just exactly like the World Series, only this is the automobile series, instead of baseball, and we know we have to have something new next year. Consequently, with plastics and other things we try to outdo each other, and the way we find out what the score is, is not by having an umpire decide, but by the amount of money we have to borrow from the bank. That is all. That is the way it all adds up. There is an old fellow with a gray beard called 'Economics,' and he finds out the score, plus and minus.

"Here in your industry—it is one of the most important industries in the world—we are learning how to make molecules, a new type of molecule business. The chemist is just a name for a molecule mechanic. Whenever you do not want to expose yourself, use a Latin or Greek derivative to say what you want. For instance, we are working on some subjects. We say that we are trying to find out why hands get warm when you rub them together, instead of getting cold. We ask a physicist and he says it is on account of friction. We ask, 'What is friction?' He says, 'It is the thing that makes your hands get warm.'

"Whenever you do not know what a thing is in English, find out what it is in Latin or Greek, and then you can get away with it, and so you will find all through physics and chemistry scores of Latin and Greek words. For instance, I have been working on some research on a subject called chlorophyl. It is just exactly the Greek for green leaf, and we do not know anymore about it in Greek than we do in English. Photosynthesis is the effect of light on a chemical reaction; we do not know any more about it in Latin or Greek than we do in English. You can tell in your industry (and I would not insist or suggest that there is anything unknown in the subject of plastics at all)—you can tell by the number of high-sounding words. Rheology is a word that slips in and you don't know why. You will find all through your industry just such words that mean absolutely nothing. It is to cover up the fact that you do not know what they are.

"Now, the first thing that you have to do when you go to certain lodges or certain churches, and they baptize you or do something to you is to take a vow and confess. If you are going to be a real, honest-to-God researcher, confess your ignorance, because the fact of the case is that you do not know anything about anything. All doctors have to know a lot about medicine in front of their patients. That is true. In fact, I hope to die under the care of some very competent physician. I think that is the only satisfaction out of living. If you are going to go back in the workshop where you make these plastics, then you have to recognize that there are one or two things you do not know about it. You are entering into a new type of chemistry, a chemistry which is going to change the whole thinking, the whole building, the whole economic phase, the modern industry. You are just getting started, so, for God's sake, don't take yourself seriously.

"When we first started to make the first distributor heads out of Bakelite, it was just before the other World War, and then Dr. Baekeland came to me and said that they needed phenol. That is just carbolic acid, but I didn't know it. I was born and raised out here on the farm, and I didn't get educated like that. He suggested we use creosol instead of phenol, but the only difference between the two was that one worked and the other did not. As a result, I paid a higher price for a fundamental education in economic chemistry than

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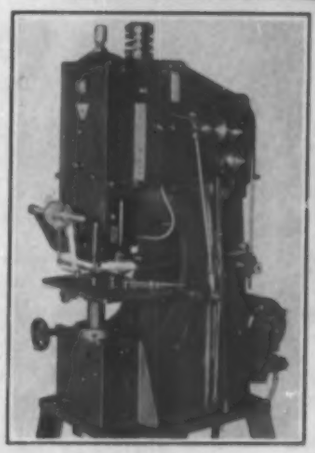

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any other guy present. Nevertheless, we got out of the difficulties and so on we go.

"Every once in a while some fellow comes around and says, 'When are you going to make plastic automobile bodies?' I say, 'Whenever the boys who are making plastics make one that will stand up.' You can't conversation an industry into existence. You have got to *build* it into existence.

"There is just one peculiarity about salesmen. They can always sell just beyond the edge. You can sell all the plastics in the world that you haven't got, but you can't sell the things that you have got. That is not characteristic of plastics salesmen only—it is universal of all salesmen. Let us go back and take what we have today and try to fix what is wrong with it. The only difference between industrial research and theoretical research is that industrial research has a customer, and you have to satisfy the customer. Start in by fixing what is wrong and you will keep him for a customer for a long while. The other fellow will lie about it, but he will soon find out about it. You have the every-day problem of just fixing what is wrong with your stuff.

"Here is an interesting thing that you might try tonight. I am sorry that the New York Central has a time schedule, but I cannot help that. You write down what you think is the most ideal plastic as it is tonight, and then come back in ten years from now and look at it. See if you ever thought you would be that foolish. In other words, if you took our automobiles of ten years ago and looked at them today, you would say, 'I do not believe they ever built automobiles like that ten years ago.' But, if I could build the automobile that you are going to see in ten years from now, it would look worse than the automobile of ten years ago, because we are in a changing world. Every day that you turn over on your calendar brings some new information in, and the only difference between success and failure is how plastic you are with relationship to the calendar. If you resist that changing calendar, you get out of date. If you get too far ahead of it, the Sheriff gets you. So, it does not make any difference whether you are in the plastics industry, the automobile business, or anything. The unfortunate thing is that we have human beings for customers and we have to sell to purchasing agents. We have a very fine general purchasing agent in our institution by the name of Charlie Miller. He has been in the business longer than I have, and that is a long while. I was telling Charlie that I am very glad I quit being a peddler before such scientific guys like you got into the business, because these fellows analyze you down to the color of your hair and everything else. I said the only fine thing I heard about a purchasing agent was this story: Several years ago a Russian Commission was sent over here to buy some gasoline engines. They were given the dimensions and so forth. There were not any engines like that in America. They had to buy some with slightly lesser revolutions. They sent for the purchasing agent, and because he did not follow the specifications—they shot him. I say there may be something to that story after all.

"To lay all joking aside, this is a new industry. We cannot tell today how much it will expand. We cannot tell what its limitations are. If you will go back ten or fifteen years, the things you are doing today were regarded absolutely impossible. The only thing you need to do in any industry is to be dissatisfied with what you have. I have said a great many times that all the research in the world was to keep the customers reasonably dissatisfied with what they had. Another definition to be given for research is to find out what you are going to do when you can't keep on doing what you are doing now.

"Your competitors determine a lot about that, but don't get the idea that you know very much and that you have done very much, because it is almost all ahead of you, and if you keep that idea ahead, there is absolutely nothing that will stop this industry.

"Now, I am not one of these fellows that are downcast. The Lord did not give me enough brains to get morose and I have been very thankful for that. In other words, I believe the future will be just exactly what you think it will be. If you want it to be a glorious thing, it will be. If you want it to be a terrible thing, it will be a terrible thing, because after all you are in this room because somebody had some idea of what this would be and kept on thinking about it, and here is what happened.

"For God's sake, do not think the future is going to be bad. I am very much interested in the future, because I expect to spend the rest of my life in the future, and I am serious about that, because most of the people are living in the past. We have history in the schools. We know where we came from, and the reason we have so much trouble is because we look back. We look back where we came from and we get a hell of a lot of surprises. I want to turn around and look where we are going."

---

## Taking it head on!

(*Continued from page 42*) material that would not only stand all normal use, but one that was very difficult to break under any circumstances. Customers for athletic goods are very much interested in the abuse an article will take, and the usual procedure with headgears is, first, to rap them over the edge of a table, and failing to break them, to stand on them and spring up and down harder and harder until something fails. The psychological result of a failure to break the headgear is tremendous even if these tests bear little relation to the loads encountered in use. For economy's sake unassembled halves were used for this demonstration and for comparative tests of materials.

These tests were conducted in a punch press where the halves, held along the joint by a groove $^{7}/_{16}$ in. deep in a board cut to fit, were struck by a flat plate

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on the ram of the press. This plate was set to give an $^{11}/_{16}$-in. free height above the board at the bottom of the stroke. Tests were made at 70 deg. and 36 deg., and a deflection and recovery test was run at 120 deg. A cellulosic material was furnished that solved the problem standing the press test at 36 deg. without breaking and yet showing good strength and recovery at 120 deg. Injected castings in this material could be jumped on or struck with a sledge several times, straightening them each time, before they will break. The untrimmed moldings weigh about $7^1/_4$ oz., have a maximum flow distance of $9^3/_{16}$ in. and a projected area of 62 sq. inches.

Inability to make perfect joints with no excess cement led to the use of an extruded colored strip covering this area. The rivets used to hold the suspension are capped with cellulose nitrate to preclude the chipping that would accompany enameling.

The finished headgear weighs just over a pound which is just about two-thirds the weight of the top grade headgears at present. It can be fitted very snug and is said to be comfortable since only the webbing touches the head instead of the entire area below the crown as formerly. This ends the annoying shifting and bobbing that made players dislike the old style. The other problem was ventilation. In return it raises a problem of its own—it has a seashell effect causing a ring when struck and making the wearer's voice sound hollow and distant. It does not interfere with his hearing in the slightest. Experiments are being conducted to attempt to eliminate this. Patents on the headgear have been applied for, but actual prolonged use on amateur and professional gridirons will determine final acceptance before the plastic helmet scores its real touchdown.

---

# Curing phenol resins

(*Continued from page 61*)

Sample No. 1. Standard; no $CrCl_3.6H_2O$

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 18 | 7800 | 7200 |
| 19 | 8200 | 8000 |
| 20 | Scorched | Scorched |

Standard curing time: 19 minutes.

Sample No. 2. Containing 5 percent $CrCl_3.6H_2O$

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 15 | 6000 | 5400 |
| 17 | 7800 | 8100 |
| 18 | Scorched | Scorched |

Proper curing time: 17 minutes.

Sample No. 3. Containing 10 percent $CrCl_3.6H_2O$

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 17 | Scorched | Scorched |
| 16 | 7500 | 7900 |
| 15 | 6200 | 6600 |

Proper curing time: 16 minutes.

Sample No. 4. Containing 15 percent $CrCl_3.6H_2O$

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 16 | Scorched | Scorched |
| 15 | 7100 | 7800 |
| 14 | 5200 | 5700 |

Proper curing time: 15 minutes.

Sample No. 5. Containing 20 percent $CrCl_3.6H_2O$

| Time, minutes | Force *W* (1), grams | *W* (2), grams |
|---|---|---|
| 15 | 6100 | 5700 |
| 16 | Scorched | Scorched |
| 15 | 6000 | 6400 |
| 15 | 5600 | 5900 |

Proper curing time: 15 minutes.

Chromic chloride does not reduce the time required for proper molding as much as does an equal percentage of stannous chloride, but nevertheless it causes a material reduction in time. As in the case of the stannous chloride, the presence of the chromic chloride reduces the strength of the molded resin to a marked degree. In the case of the former, the strength was cut about 12 percent with the resin containing 20 percent of the salt, but the latter in the same proportions lowered the breaking strength by a full 25 percent.

As may be seen in the recorded data, two tests were made on each sample to determine the breaking strength. The very nature of the bend test is such that exact checks could not be expected, but the average run of the values obtained indicates that a satisfactory degree of uniformity was maintained throughout the series of tests.

### Conclusions

1. Stannous chloride and chromic chloride are catalysts for the curing of phenol-formaldehyde resins.
2. Stannous chloride is a more active catalyst than chromic chloride.
3. Proper technique will reduce the corrosive effect of stannous chloride on the chromium plating somewhat, but this is still more than can be tolerated. Chromic chloride does not attack the mold.
4. Both chromic and stannous chlorides materially reduce the strength of the molded resin.
5. To reduce the molding time 25 percent, there must be added to the molding powder 10 percent of its weight of stannous chloride or 20 percent of its weight of chromic chloride.

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# Manufacture of synthetic phenol resins

(*Continued from page 64*) vacuum distillation.

In practice the second stage system operates by cycling the reactants in vapor state, at slight negative pressure, in succession through contact chambers, heat interchangers, a vapor superheater, a fractional condensing tower and a scrubbing tower. When and as conversion to form second stage products takes place, these products condense and are collected from the fractional condenser and the scrubbing tower. Throughout the second stage system efficient heat interchange principles are utilized to avoid condensation and re-evaporation of the reactants and to utilize the heat of the products of the reaction. An examination of the two reactions, above, will disclose the production of phenol from benzene and air by utilizing hydrogen chloride, in a sense, as an oxygen carrier.

From this brief description of the process, which is continuous and which involves a regenerative cycle with respect to hydrochloric acid, it would appear that the many successive steps necessary require an elaborate system of exact control and synchronization with each other. Such is not the case in practice; on the contrary, in both stages of the process the reactants in the vapor state are caused to move in succession through contact chambers, heat interchangers or heat recovery apparatus, a fractional condensing tower, a final condenser, or its counterpart, and vaporization apparatus. Only when and as conversion takes place do the products of the reactions condense and flow from the condensing equipment to be collected. If no reaction took place, steam, water and electrical energy would be expended only for vaporizing, moving and condensing the reactants but the reactants would be substantially recovered in original form, minus, mechanical losses.

Reference to the flow sheet will clarify the operation of the process. Liquid flows are represented as solid, vapor flows are dotted. (*See page 64*)

Starting at *A*—*E1* is a steam-heated tubular evaporator which is boiling benzene from a mixture of benzene and phenol into fractionating Column *C1*. The benzene vapor passes through a tubular heater, 2, in the vapor superheater, and then into vapor mixer *3*. Hydrochloric acid is boiling from *4* into vapor mixer *3* and the air is being drawn into vapor mixer 3 through tubular heater 2*A*, in the vapor superheater. The mixture of these three vapors in proper proportion and at a temperature of about 205 deg. C. passes into contact chamber *6* where chlorination takes place. The products from chamber *6* pass into scrubbing tower *8* wherein condensation to liquid form takes place to form crude chlorbenzene which flows from the bottom of tower *8* to storage for subsequent continuous fractional distillation. Above tower *8* is condenser *8* which condenses benzene vapor driven off in the tower. Part of this distillate is used as reflux for the tower while the balance is used to extract phenol in the second stage.

Item *5* is a suction fan which draws the reactants through the first stage system. This fan discharges into a scrubbing tower in which benzene is absorbed from the tail gases by a hydrocarbon oil from which the dissolved benzene is continuously distilled for re-use.

Starting at *B*—a mixture of pure chlorbenzene and water is added into the top of scrubbing column *25* within which the products of the second stage reaction are circulated by a turbo-blower, *21*. The temperature conditions in column *25* are maintained so that the azeotropic mixture of chlorbenzene and water is formed to augment the vapors leaving the column. The excess water added at this point absorbs the HCl from the vapors and the recovered HCl solution (15 percent) flows from the bottom to the vaporizer in the first stage system at *4*. The vapors leaving the top of column *25* consist of chlorbenzene, water and phenol and pass into the bottom of the phenol washer *26* which is refluxed with hot water to dissolve out the phenol and which is operated at a temperature such that the azeotropic mixture of chlorbenzene and water remains in the vapor state. The phenol-water solution leaving the bottom of column *26* is passed through extractor *28* wherein the phenol is extracted by benzene. The phenol-benzene extract from the top of extractor *28* flows to evaporator *E1* to supply the benzene vapor for the first stage while the crude phenol from the evaporator is sent to storage for subsequent purificat on by continuous vacuum distillation.

The chlorbenzene-water vapor leaving the top of column *26* is picked up by turbo-blower *21* and passed through tubular heat exchanger *22* to be raised in temperature by absorbing heat from the hot products of the second stage reaction coming from contact chamber *24*. Leaving exchanger *22* the reactants lack about 100 deg. C. in temperature so they are passed through tubular heater *23* in the vapor superheater and then directly into the second stage contact chambers *24*. Leaving chambers *24* the hot products exchange sensible heat with the incoming reactants and are thereby partly cooled. From the heat exchangers 22 the products then go directly to the bottom of the acid recovery tower *25*.

The process is of particular interest with respect to the following:

1. For all practical purposes the process is regenerative with respect to hydrochloric acid as indicated by the equations and as evidenced by the fact that the normal operating efficiency of the HCl recovery cycle is about 97 percent. This efficiency includes loss of HCl in the form of higher chlorinated benzenes and all mechanical losses in handling.

2. The process forms by-products to the extent of only one-tenth of a pound per pound of pure phenol produced, these being small quantities of polychlorbenzenes, diphenyl compounds and tarry matter.

3. The first stage catalyst is truly selective towards benzene in that unsaturated compounds or toluene are not chlorinated but are oxidized to $CO_2$ and CO; thus no trace of cresols exists in the phenol itself since

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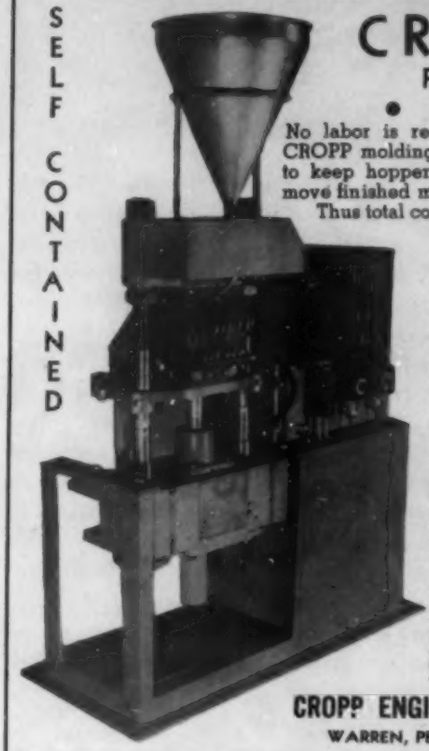

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State of New York } ss.
County of Kings }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Chas. A. Breskin, who, having been duly sworn according to law, deposes and says that he is the Publisher of the MODERN PLASTICS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Name of — Post Office Address

Publisher, Chas. A. Breskin, 122 E. 42nd St., New York City.
Editor, Wm. T. Cruse, 122 E. 42nd St., New York City.
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Business Manager, A. S. Cole, 122 E. 42nd St., New York City.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

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5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is..... (This information is required from daily publications only.)

CHARLES A. BRESKIN, Publisher.

Sworn to and subscribed before me this 24th day of September, 1940.

[SEAL] HERMAN L. ISLER
Notary Public, Kings County
Kings County Clerk's No. 2012.
New York County Clerk's No. 26, Register's No. 2-I-19.

(My commission expires March 30, 1942.)

it has a solidification point of 40.70 deg. C. minimum.

4. Equipment items handling hydrochloric acid liquid, or vapor, are so designed that maintenance is reduced to a figure not above the maintenance encountered in the average chemical plant.

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## Continuous length extrusion

(*Continued from page 49*) is expected that the soft twist will be limited to uses where the ends are permanently fastened to fittings, as in snelled hooks, while the harder twist may be used for leaders. Other uses for which the hard twist is being tested include braided belts, millinery and dress trimmings.

Single, colored filament in .010-in. diameter is used for wrapping and trimming fishing rods. Offering more durability than silk, it is also very attractive. And jumping from fish to insects, we find that extruded vinylidene chloride is now undergoing service tests in various parts of the country for use as screens. Results to date, it is claimed, indicate that an absolutely non-corrosive, durable fly screen of extruded plastic will soon be commercially available.

Textile concerns are experimenting with some of the finer threads for use in weaving fabrics and braids. This type of thread has also been used as decorative stitching on leather goods, particularly on shoes. Panel inlay designs of the plastic in combination with other shoe materials create an unusual effect.

A very interesting and highly efficient use for extruded vinylidene chloride was inspired in a most casual way by a physician in Michigan. The doctor happened to have a piece of fishing leader material made of the extruded plastic and after examining it, he decided to subject it to various tests. He finally decided that, if the material could be made in the form of tubing and in certain sizes, it might supplant the French product formerly used exclusively in this country for catheters. It was not long before the doctor was using plastic catheter tubing for his patients and pronouncing it entirely satisfactory. The material has proved to be sufficiently x-ray opaque and it can be repeatedly sterilized without impairing its service qualities. One firm has developed a method of satisfactorily forming the ends of this tubing which makes it ideal for the exacting requirements of the medical field. This tubing is made only in small sizes—from .66 in. O.D. down to .35 in. O.D.; with a minimum wall thickness of .010 inch. Because of its strength, moisture and solvent resistance, electrical properties and non-flammability, extruded vinylidene chloride will probably be adopted quite generally for catheters and insulation for fulguration electrodes. The extruded material is now in use in several hospitals and is considered an improvement over the type previously used for certain applications.

Vinylidene chloride extruded in tape form has equal strength in all directions rather than having it concentrated lengthwise. It is suitable for many applications

Plastics are so widely used in relation to other plastic and metal parts that close tolerances for warpage must be maintained. A great help in holding "form" is to be sure of correct molding temperatures by frequent checking of the various cavities with the Cambridge Mold Pyrometer.

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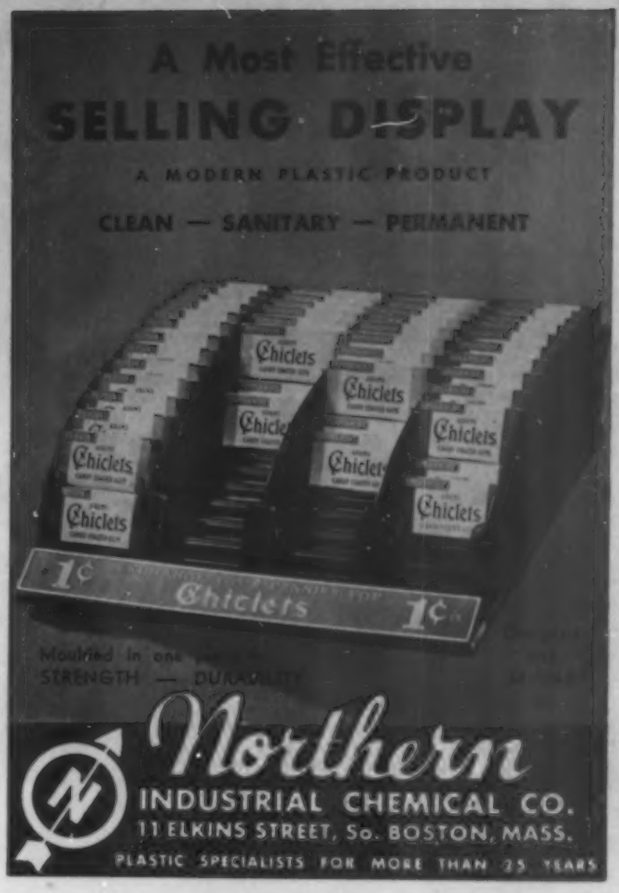


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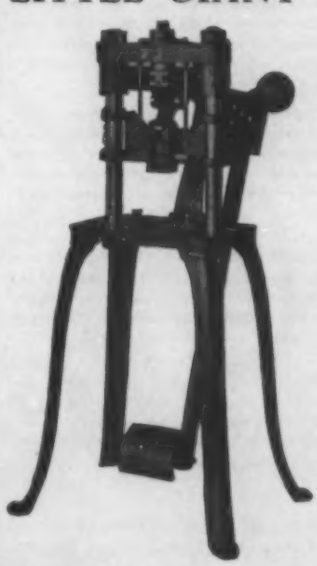

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**FOR SALE: Birm. 6" x 12" Lab. Rubber Mill, M. D.; 10—Semi-Auto. Presses, 75 to 400 ton, ejectors and pull-backs; 2—40" Mixing Rolls; 4—Gould Triplex Hydraulic Pumps, 2—1500 PSI, 35 GPM, 2—3000 PSI, 18 GPM; 2—W.S. 4-cyl. opposed Hydraulic Pumps, 6000 PSI, 25 GPM, 100 HP motor drive; W.S. Hydro-Pneumatic Accumulator, 8" ram, 48" stroke, 42" air cylinder, 5000 PSI; 3—24" x 24" Hydraulic Presses; 4" Extruder; 7—W. & P. Mixers. Send for Complete List. Reply Box 385, Modern Plastics.**

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such as insulation tape for plating racks and for electrical service, also for belts and watch straps.

Already familiar is the porch and terrace furniture woven of strips and strands of extruded acetate butyrate and ethocellulose. The colors are bright and gay, while patterns and combinations of colors are practically limitless. Toughness, durability and color fastness are features that are winning popular approval.

## Triple threat to molars

(*Continued from page 44*) resistant type of phenolic was chosen for this application because of the high heat generated by the bulbs. The fact that the plastic will not discolor, check or crack makes it an ideal material for this use.

The second part of the light consists of a fluorescent lamp housed in a compression-molded urea shade of an elongated shape, which permits the illumination to be spread over the instrument tray and dental unit panel board. The illumination approximates "north-sky" light which insures better results in delicate shade blending and color mixing for artificial dentures. Swung forward, this light will illuminate the patient's mouth during shade matching and there is no glare! Dental radiograms, or x-rays, can be clipped to the plastic shade and viewed directly by the soft, diffused, neutral light of the fluorescent tube. This shade is available in cream white, ivory, tan, black and mahogany to harmonize with various office interiors.

The third and completing part of the unit is an inverted bowl type reflector that sends a flood of soft light to the ceiling and walls, which by reflection is redirected so that the entire room appears comfortably bright. A "three-lite" type of incandescent bulb is used that allows a selection of intensities ranging from 100, 200 or 300 watts to 200, 300 or 500 watts. The actual bulb in this indirect unit is not visible; only the reflected light flooding the room, is apparent.

## The Magic of Modern Plastics

The Publicity Department of Modern Plastics announces that its new 16 mm. film in sound and color is now ready for distribution to clubs, business groups and associations, chemical societies, colleges and other interested organizations. The film entitled "The Magic of Modern Plastics" runs for about 40 minutes. This film describes a new world of opportunity for American industry, and carries a vital message for every manufacturer. The prize-winning items in the Fifth Annual Modern Plastics Competition are shown.

The movie is available without charge or obligation except that each group must make provision for a 16 mm. sound projector and assume transportation charges one way.